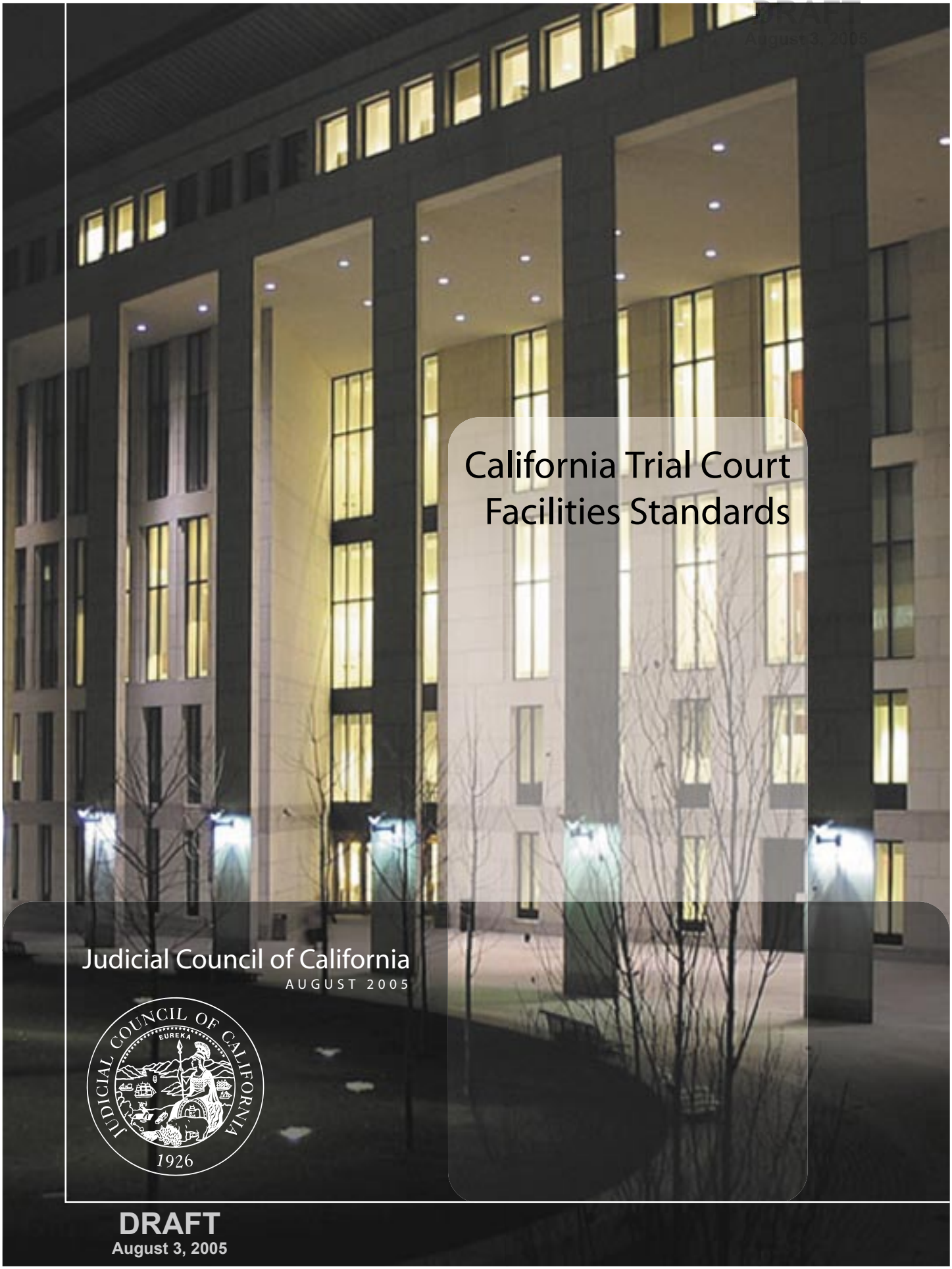

California Trial Court Facilities Standards

Judicial Council of California

AUGUST 2005

DRAFT
August 3, 2005

Public Entry

Edward W. Brooke Courthouse

Boston, MA

Kallmanm, McKinnell & Wood Architects

PREFACE

The Judicial Council of California, pursuant to Gov. Code, § 70391 has full responsibility, jurisdiction, control and authority for trial court facilities and shall adopt appropriate facilities standards. The Administrative Office of the Courts (AOC), Office of Court Construction and Management (OCCM) pursuant to Gov. Code, § 70391, as staff to the Judicial Council, has the responsibility to prepare and present to the Judicial Council recommendations for policies and procedures and guidelines for ensuring that the courts have adequate and sufficient facilities.

With the transfers of responsibility for design, construction, and management of court facilities from counties to the state, the AOC has determined that it is prudent to develop standard expectations that reflect the best practices and successful solutions for basic components of the trial court building. Upon adoption by the Judicial Council, the AOC, in accordance with Rule 6.183 of the California Rules of Court, will apply these California Trial Court Facilities Standards (Facilities Standards) for design and construction of court facilities.

These Facility Standards shall be utilized with professional care as defined in the Agreement for Services between the AOC and consultants retained for specific projects, and shall be used in conjunction with applicable codes, project specific programs data, and project requirements as the basis of design for new court facilities in California. For each court building project the AOC and the affected court will establish an advisory group consisting of court judicial officers, other court personnel and others affected by the court facility to work on the implementation of the Standards for the specific building design.

This volume replaces the *Trial Court Facility Guidelines,* adopted by the Judicial Council of California effective July 2002.

This 2005 edition has been created as standards, not guidelines, for court design, and was developed utilizing input from a variety of sources, including: the review of earlier facility guidelines; input from knowledgeable judges, court administrators, court facility planners, and facility operations technicians; experience of architects and engineers; and references such as federal and other state court facility standards. The updating process included site visits to existing courthouses, interviews with local court administrators and courthouse security providers, and workshops on each subject area with source experts. These statewide post-occupancy evaluations of selected existing courthouses enabled OCCM to gain a broader perspective on court facility planning and operational requirements. Throughout the process, "lessons learned" were identified and discussed. Topic specific workshops were held to identify and update the design criteria.

The Facility Standards will provide long term overall value to the judiciary, the courthouse users, the community in which they reside and the taxpayers of California. The Standards attempt to maximize value to the State of California by balancing the aesthetic, functional and security requirements of courthouse design with the budget realities of initial construction cost and the long-term life cycle costs of owning and operating institutional buildings.

Judicial Council of California
Administrative Office of the Courts
Office of Court Construction and Management
Design and Construction Services

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GENERAL PRINCIPLES

aerial view

San Francisco Civic Center Courthouse
San Francisco, CA
RossDrulisCusenbery Architects
Hood-Miller Associates
Mark Cavagnero Associates/ John M.Y. Lee

1. INTRODUCTION

The California Trial Court Facility Standards (Facility Standards or Standards) defines the minimum space, functional, technical, and security requirements for design of new court facilities in the State of California. The Facility Standards reflect best practices and successful solutions, as the basis for achieving design excellence within contemporary court facilities.

The Facility Standards are criteria to be used by design professionals, the judiciary, court administrators and facility planners. The Standards will serve as a comprehensive, multidisciplinary resource of planning and technical criteria. Each project has many variables influencing design decisions, including courthouse size, calendar type, location, climate, geography, and site context. The Standards provide a baseline of understanding, by describing the programmatic, design and operational concerns common to court facilities, and illustrating how they may reasonably be applied to meet the needs of individual projects statewide.

The Judicial Council of California is aware that design of California courthouses will continue to evolve, and the information contained in the Standards will be updated periodically.

The Standards represent minimum planning and design expectations; design professionals shall understand that these Standards do not exempt them from meeting the professional standard of care.

This document is intended primarily for new court building projects. However, many of the design criteria and performance standards may be applicable for court renovation projects and building system upgrades in existing court buildings. Future chapters may be added to the Standards to address these issues.

1.1 DESIGN PRINCIPLES

Design Excellence

The Standards require implementation of design excellence principles, collectively known as the *Principles of Design for California Court Buildings.* These principles are adapted from and based, in part, on the *Guiding Principles for Federal Architecture,* by Daniel Patrick Moynihan, Hon. AIA, former U.S. Senator (N.Y.), 1962, and the *Excellence in Public Buildings Initiative,* by Stephan Castellanos, FAIA, former State Architect of California. These principles include:

- Court buildings shall represent the dignity of the law, the importance of the activities within the courthouse, and the stability of the judicial system;
- Court buildings shall represent an individual expression that is responsive to local context, geography, climate, culture, and history, and shall improve and enrich the sites and communities in which they are located;
- Court buildings shall represent the best in architectural planning, design, and contemporary thought, and shall have requisite and adequate spaces that are planned and designed to be adaptable to changes in judicial practice;
- Court buildings shall be economical to build, operate, and maintain;
- Court buildings shall provide a healthy, safe, and accessible environment for all occupants;
- Court buildings shall be designed and constructed using proven best practices and technology, with careful use of natural resources, and controlling long-term ownership costs.

Flexibility in Design

California court facilities shall be planned, to the extent feasible, for programmatic flexibility and growth.

- Incorporate flexibility into building design. Court facility space needs change over time. Examples of programmed flexibility include: designing standard courtroom sizes with capacity for juries, and designing standard structural modules with adequate capacity to convert to future courtroom space.
- Floor-to-floor heights, location of vertical and horizontal circulation systems, and column bay spacing shall be sized to allow renovating office spaces into courtrooms. This approach will permit expansion of the judiciary within buildings containing existing court spaces and building infrastructure, including central holding, prisoner transfer elevators, and electronic security systems. Building infrastructure and raceway systems shall be sized and located to allow future expansion.

Small, Medium and Large Courthouses

Design responses to programmatic needs will vary, depending on the court facility size, type, and location. For example, a small rural courthouse requires a different architectural scale, exterior cladding, room sizes and building systems than those required for a large urban courthouse. Design professionals shall modulate design solutions to ensure they are consistent and appropriate for the court type, size, location, context, project complexity, and community they serve.

Building Orientation and Wayfinding

Many court facility users, especially first time visitors, are unfamiliar with the public functions and spaces in the courthouse, and require assistance in determining where they need to go. Clear circulation, wayfinding visual cues, signage, and graphics are important design elements that will minimize confusion and enhance the visitor's experience when using the courts.

Provide clear and identifiable pedestrian paths of travel to courthouses and internal corridor and site circulation systems to allow the public to easily understand the facility's organization. Provide a coordinated series of visual cues placed in strategic locations to allow visual orientation to key functional public areas including courtrooms, clerk's office, self-help centers, and the jury assembly room.

Views to the outdoors, architectural elements, windows, doors, skylights, public art, landscaping, color, texture, and scale are among the design opportunities which can be applied when developing a wayfinding program. Other visual strategies that enhance orientation include stylized door types, door surrounds, and interior glazing in addition to standardized, multi-lingual signage. These elements encourage building users to rely on intuitive decisions, rather than signage only when navigating the building.

Other wayfinding strategies:

- Design the public lobby as a focal point for the entire facility. Locate the entries of high volume public use spaces so they can be seen directly from the public entry lobby. If locations of high volume spaces cannot be seen from the lobby, provide visual clues immediately upon entering the building.
- Provide clear, concise, and attractive graphics, signage and visual elements so visitors can locate their destinations without asking security personnel or courthouse staff for assistance.
- Plan and locate public toilet rooms, waiting areas, courtrooms, and public areas in the same areas on each floor to enhance orientation.

1.2 SUSTAINABLE DESIGN

Expectations and design goals for sustainable trial court buildings in California provide the basis for planning and design solutions, as outlined below.

Objectives

Architects and engineers shall focus on proven design approaches and building elements that improve court facilities for building occupants, and result in cost effective, sustainable buildings. All new courthouse projects shall be designed for sustainability and at a minimum, to the standards of a LEED™ 2.1 "Certified" rating. Depending on the project's program needs and construction cost budget, projects may be required to meet the standards for a LEED™ 2.1 "Silver" rating. At the outset of a project, the AOC will determine whether a project will participate in the formal LEED™ certification process of the United States Green Building Council (USGBC).

Design Criteria and Performance Goals

The following design criteria and performance goals are universally applicable to all court buildings. They shall provide a direct benefit to building occupants, and reduce ownership costs.

- Comply with LEED™ criteria as described above.
- Plan and design for flexibility, to anticipate future changes and enhance building longevity. Use modular planning and flexible building infrastructure for HVAC, power, security, and communications systems.
- Use natural strategies to protect and restore water resources. Limit disruption to existing vegetated areas. To purify runoff and promote groundwater recharge, use natural storm water treatment systems such as bioretention, bioswales, and permeable paving.
- Improve energy efficiency and ensure thermal comfort. Optimize the building envelope and develop passive solar strategies. Design energy-efficient HVAC systems. Use energy analysis to refine the design so that whole building energy consumption is at least 15 percent less than permissible for a code compliant court building. Perform building commissioning to ensure that systems perform as designed. Coordinate daylighting with high-efficiency electric lighting and programmable controls.
- Promote occupant health and well being in the indoor environment. Provide a connection to natural daylight, optimal lighting and acoustics, and good indoor air quality. Develop systems and detailing to ensure thermal comfort and prevent microbial contamination. Use natural ventilation, with HVAC systems to promote effective ventilation; consider localized occupant-controlled systems.
- Plan for recycling of materials during construction, demolition, and occupancy. Develop specifications for construction recycling; require contractors to develop a construction waste management plan that identifies companies licensed to recycle materials. Provide collection bins for recyclable materials on each floor and a staging area for materials collection.

The following design criteria and performance goals shall be applied as best practices:

- Conserve water and consider water reuse systems. Use low-flow plumbing fixtures, water-efficient appliances, and energy efficient HVAC equipment. Consider collection of rainwater, reuse of gray water for non-potable uses, and constructed wetlands for natural wastewater treatment.
- Use environmentally preferable building materials. Evaluate the life cycle environmental impacts, resource efficiency, and performance of building materials. Seek out nontoxic materials from local, renewable, and sustainably acquired resources that minimize waste and pollution from manufacturing, installation, and maintenance. Use wood products from independently certified, sustainably managed sources. Do not use tropical hardwoods.
- Use appropriate plant materials. Reduce maintenance and irrigation requirements by giving preference to native plant species. Explore opportunities to provide habitat for wildlife and to restore degraded site areas.
- Select and develop sites to promote livable communities. Seek opportunities to redevelop existing sites. Develop links to public transit and create strategies for pedestrian-friendly, mixed-use communities. Consider regional land-use patterns and impacts to the watershed and wildlife habitat. Provide dedicated open space, greenways, and flyways.
- Reduce environmental impact related to energy use. Investigate opportunities to reduce reliance on fossil fuels and to use cleaner power sources. Consider cogeneration, fuel cells, photovoltaics, solar hot water, and other renewable energy sources. Explore the potential to use green power. Consider overall source energy use when evaluating system options.

Participation in Energy Savings Programs

Participation in the California Savings By Design Energy Efficiency Policy, or other programs which are or may become available, is encouraged to promote energy efficiency and environmental awareness, and as a guide for sound energy use and cost decisions.

Programs such as California's Savings by Design

program address energy efficiency in new construction and renovation projects. Such programs may be administered statewide and funded by utility customers through the Public Purpose Programs surcharge applied to gas and electric services. Free services offered under programs such as these include design assistance, energy efficiency analysis, life cycle cost, and financial incentives for the facility owner and design team.

- As long as the Savings by Design program is funded by the California Energy Commission, all new California court facilities may participate in the Savings by Design program and implement energy efficiency measures that satisfy the project's financial criteria.
- Upon designation for energy savings programs, all court facilities may be analyzed using the "whole building approach". Life Cycle Cost Analysis (LCCA) shall be performed to determine cost-effective energy efficiency measures to be included in the design.
- All court buildings shall exceed the California Energy Code Energy Efficiency Standards by at least 15 percent.

1.3 PHYSICAL DURABILITY AND FUNCTIONAL USEFULNESS

California court facilities shall be designed to provide long term value to the State and the judiciary, by balancing initial construction costs with projected life cycle operational costs. To maximize value, and limit ownership costs, the Standards require architects, engineers, and designers to develop building components and assemblies that reflect functional life cycles, as listed in Table 1.1 (Functional Life of Building Components or Assemblies).

Life Cycle Cost Analysis

Selection of building components, materials and systems must consider long-term costs for operations and maintenance. Applying Life Cycle Cost Analysis (LCCA) when reviewing design options and selecting design alternatives provides useful indicators on initial and future costs.

- LCCA shall be applied to identify the lowest cost alternatives over a 25-year life cycle for design alternatives.
- Provide a minimum 25-year life cycle cost for construction, maintenance, operational and recurring costs, using the building LCCA program available from the Federal Energy Management Program (FEMP).
- Energy consumption costs shall be calculated from annual energy usage reports generated by compliance software, and utility rate schedules. The annual discount, inflation, and escalation rates shall be determined prior to start of project.

1.4 ACCESSIBILITY

The American with Disabilities Act (ADA) of 1990 significantly strengthens the laws of accessibility in public buildings, such as courthouses. The American with Disabilities Act Accessibility Guidelines were issued by the Access Board in 1991 and became the enforceable ADA Standards for Accessible Design.

Accessibility is an integral component of civic building planning and design. As an essential element of the justice system, courthouses must remain accessible to the public. Due to the unique spaces and functions occurring within courts facilities, these public buildings, especially older facilities, often present unique access challenges for persons with disabilities.

> *Universal Design is the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design.*
>
> Ronald L. Mace, FAIA (1941-1998)
> Founder of The Center for Universal Design

The design team shall use Universal Design to ensure equal access to court facilities. The intent of Universal Design is to simplify life for everyone by making products, communications, and the built environment more usable by as many people as possible, regardless of age, ability, or condition. Most people experience changing physical abilities over a lifetime and benefit from barrier-free design.

Universal Design

- Equitable Use: The design is useful and marketable to people with diverse abilities.
- Flexibility in Use: The design accommodates a wide range of individual preferences and abilities.

- Simple and Intuitive: Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level.
- Perceptible Information: The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.
- Tolerance for Error: The design minimizes hazards and the adverse consequences of accidental or unintended actions.
- Low Physical Effort: The design can be used efficiently and comfortably and with a minimum of fatigue.
- Size and Space for Approach and Use: Appropriate size and space is provided for approach, reach, manipulation, and use regardless of user's body size, posture, or mobility.

The Center for Universal Design (1997)
The Principles of Universal Design, Version 2.0
Raleigh, NC: North Carolina State University

Universal Design principles shall be incorporated into court facilities design by evaluating advantages to each space and situation, to ensure barrier-free conditions. Examples of advantages include: access, egress, reach, sight lines, and security.

Component	Target Functional Lifetime (Years)
Architectural Elements: Shell and Core	
Foundations, Horizontal, Vertical Framing & Floor Structures	50 - 75
Exterior Cladding	50
Curtain Wall and Glazing	30
Roofing/Sloped Roofs, Metal or Tile	50
Low Slope (Flat) Roof Membranes	20
Core Spaces, Public Restrooms, Stairs	50
Interior Construction	
Permanent/ Partitions	50
Improvements Requiring Periodic Remodeling	20
Casework and Finishes in Courtrooms	25
Stone, Terrazzo, Ceramic Tile Flooring	25
Other Casework	20
Vinyl Composition Tile (VCT), Linoleum, AC Tile	5-10
Carpet and Wall Coverings	5-7
Heating, Ventilating, and Air Conditioning Systems (HVAC)	
Primary Water Cooled Equipment	25
Primary Air Cooled Equipment	12
Distribution Systems	50
Control Systems	15
Trim/ Diffusers	20
Pump Seals	5
Emergency Standby Generators	25
Electric Motors	10
Electrical Systems	
Primary Equipment (Switch Gear, Transformers)	25
Distribution System	50
Fixtures	25
Low Voltage/ Security/ Access Control	15
Engine-Generator Set	25
Plumbing Systems	
Primary Equipment, Pumps, Boilers	15
Distribution Piping	50
Fixtures	50
Valves, Faucets, Trim	10
Fire Protection Sprinkler Systems	50

Table 1.1Functional Life of Building Components or Assemblies

2

COURTHOUSE ORGANIZATION

Exterior

Phoenix Municipal Courthouse
Phoenix, AZ
HOK Architects and DMJM Architects

2.1 BUILDING ORGANIZATION

Various courthouse functions have different space, circulation, access and security requirements. Site and program constraints of each project will determine the optimum organization or configuration of a specific court facility. In standard full-service courthouses, courtrooms are commonly provided in multiples of two sharing one court floor holding unit. This arrangement allows sharing of in-custody elevators and holding cells. General organizational principles are described below.

2.2 PROGRAM STACKING/ZONING

Courthouse organization is segregated both horizontally and vertically.

Large Facilities: High volume public spaces and services are located on the lower floors of court facilities directly adjacent to the public lobby while courtroom functions are on upper floors. Lower floor functions typically include the offices of the court clerk, jury services and jury assembly room, child waiting rooms, records, public cafeteria, self-help centers and other frequently visited public areas. If these functions are located on the second floor of the building provide a connecting set of stairs from the main public lobby to access these areas in addition to public elevators. Functions requiring less public contact or quieter surroundings, including courtrooms, court administration, judges' chambers shall be located on the upper floors. Functions requiring higher security levels including law enforcement waiting, in-custody receiving and holding, and security command centers shall be located below ground level floors.

Small Facilities: High volume public spaces and services are located directly adjacent to the public lobby while courtroom and high security functions are located in more remote, quieter locations.

Criminal courthouses require three separate and distinct zones of public, restricted and secured circulation. Figure 2.1 (Section Showing Three-Part Circulation System) indicates the vertical rela-

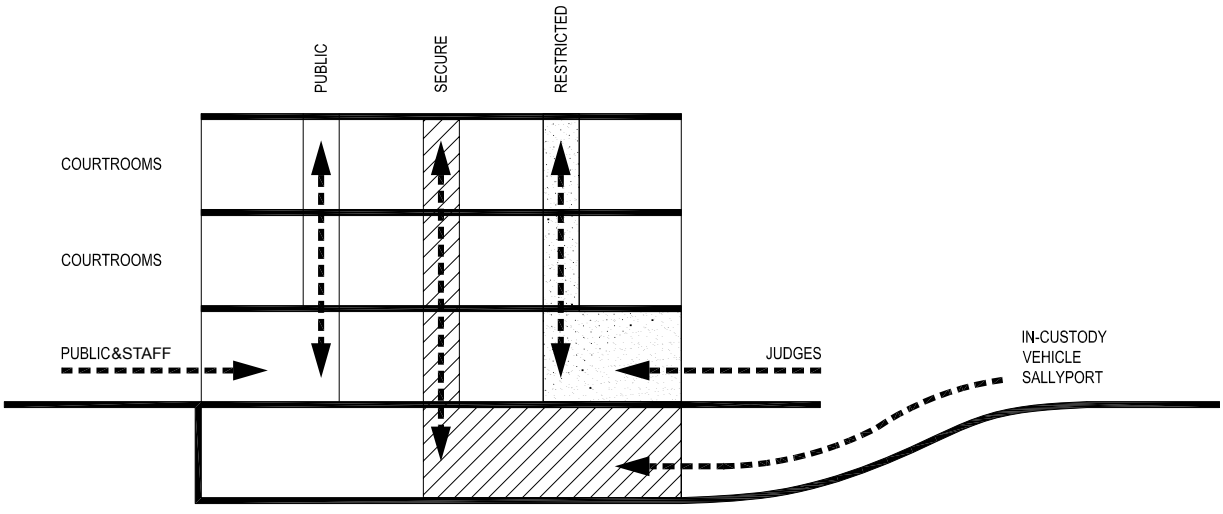


Figure 2.1 Section Showing Three-Part Circulation System

tionships of the three-part circulation system in a multilevel courthouse. The exact locations of these circulation systems may vary depending on the location of departments and uses within the building. Civil court facilities may only require two dedicated circulation zones, public and restricted because in custody cases are not frequently processed in these facilities. Controlling unauthorized movement from a public zone to a restricted zone is a security requirement. Separate all zones with access control systems, sally ports and authorized entry protocols monitored from a central courthouse security control room utilizing electronic monitoring and duress alarm systems. The three zones of horizontal and vertical circulation shall only intersect in controlled areas including courtrooms, sallyports and central detention. A brief description of the three circulation systems, illustrated in Figure 2.2 (Circulation Diagrams) follows.

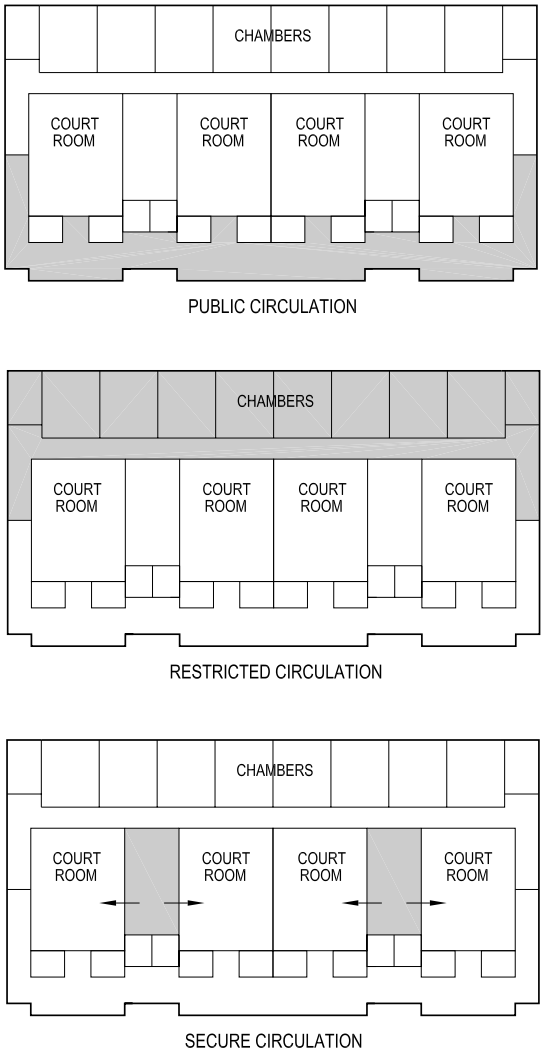


Figure 2.2 Circulation Diagrams

Public Circulation System

Provide a corridor circulation system linking the public lobby to all public parts of a court building. The overall building organization must be easily understood and defined by this circulation system. Introduce natural light into public and restricted corridors where possible, and simplify building orientation and way finding to and from all public spaces and courtrooms.

The public circulation system provides access from the public point of entry to the controlled access points of restricted and secure areas of the courthouse. All areas that have a public service counter, or requires access by the general public, shall be accessible from the public circulation system. These areas include the courtrooms, public counter areas, jury assembly room, mediation and Alternate Dispute Resolution (ADR) centers, administrative office, public waiting areas, food service or vending areas, children's waiting area, public restrooms, public elevators and other public reception areas. If the court shares a building with non-court activities, provide a separate entrance for the non-court functions. The public circulation system also includes the public waiting areas immediately adjacent to courtrooms and attorney conference rooms. Appropriately size the public circulation corridors to allow for adequate waiting areas by providing "wide spots in the road" for benches or other break out areas for conversation and waiting. If possible locate the public circulation system on the perimeter of the court floors. Provide windows to these spaces allowing natural light in and promoting a sense of transparency to the public on the outside of the judicial process within.

Restricted Circulation System

The restricted circulation corridors provide access to court staff, judicial officers, escorted jurors and security personnel. These corridors and vertical circulation systems connect courtrooms, chambers, support space, jury deliberation rooms and authorized staff parking areas. The restricted circulation system cannot be bisected by the public circulation system. Building service functions, including storage, staging and loading areas, security staff offices and other sup-

port areas, are located within the restricted circulation zone. The restricted circulation system can include connecting stairs between staff areas on other floors. Depending on the location, the building's existing smoke stair system can be utilized for this function. Analyze the security, fire exiting and smoke stair air evacuation system requirements prior to implementing this option.

Secured Circulation System

Separate the secured circulation system for in-custody defendants from the public and restricted circulation zones. The secure circulation system provides access between the secured in-custody entrance (sallyport), central holding and intake areas, secure attorney interview rooms, courtroom holding areas and the courtrooms. The design of these areas shall prohibit unauthorized access by the public and escape by persons in custody. California Code of Regulations, Title 15, § 1105(c), requires that court holding facilities have a secure path of travel for in-custody defendants and is separate from those used by the public. Secure circulation corridors, elevators and stairwells should minimize turns, alcoves and other potential hiding places. The use of video surveillance within security corridors by the court security staff is recommended.

2.3 SPACE STANDARDS

Space Standards

Table 2.2 (Space Standards) lists the space standards for functional areas of California court facilities.

Ceiling Heights

Table 2.1 (Typical Ceiling Heights) lists the ceiling height requirements for functional areas of California court facilities. All ceiling heights are measured to the face of ceiling finish. In courtrooms and public lobbies ceilings may also include architectural elements including soffits, coffers, reveals and other architectural features.

Corridor Widths

The following minimum and maximum corridor widths apply

- Public Corridors: 8' – 12' depending on code requirements for occupancy loading and amount of public waiting that is provided in the corridor.
- Restricted Corridors: 5' – 6' depending on code requirements for occupancy loading.
- Secure Corridors: To be determined per space requirements of the local courthouse security provider.

2.4 AREA AND VOLUME DEFINITIONS

This section defines terms used in the planning and measurement of court building size and volume, and ratios resulting from the implementation of these standards. To determine the size and volume of California court facilities the following definitions apply:

Net Square Feet (NSF)

NSF is the assignable amount of space required for a specific employee classification or function exclusive of interior walls or internal circulation area. The Facility Standards includes space standards that are described in NSF. For example, a trial courtroom space standard of 1,650 NSF describes the courtroom floor area measured to the face of finishes excluding the thickness of demising walls. Functional areas to be included in the assignable NSF include but are not limited to: court floor public waiting areas, weapons screening stations and the public queuing aisles serving them, server and telecommunications equipment rooms, courtroom technology closets, public entry lobby vestibules, courtroom vestibules, court floor holding, public waiting areas for all public service counters, self help public access computer stations, elevator equipment rooms, fire control rooms, court security control rooms and contract security officer support spaces.

Space	Height
Courtroom	12'
Chambers	8'-10'
Public Lobby	Varies
Open Plan and Private Offices	9'-10'
Clerk's Public Spaces	10'-12'
Jury Assembly Room	10'-12'
Jury Deliberation Room	8'-9'
Public Corridors	10'-12'
Restricted Corridors	8'-9'
Ancillary Spaces	8'-10'

Table 2.1 Typical Ceiling Heights

Component Gross Square Feet (CGSF)

CGSF is the amount of area required by a department or component for it to individually function with in a court facility. Calculate CGSF by multiplying a department or component's total NSF by a circulation factor, which provides area to support departmental internal circulation, partitions and structural members and columns within the space. Circulation factors range for typical spaces depending on the type and size of the spaces in a component.

Building Gross Square Feet (BGSF)

Courthouses require a relatively high grossing factor because of the multiple levels of circulation, mechanical areas, structure and vertical penetrations. For pre-design purposes, building gross square feet (BGSF) is typically 1.3 to 1.4 times the CGSF of all court facility tenant groups. For example: estimating the BGSF of a proposed courthouse of 100,000 CGSF would result in 100,000 CGSF x 1.35 = 135,000 BGSF.

Figure 2.3 (Courthouse Efficiency Factors) illustrates NSF, CGSF and BGSF.

Total Building Area

Application of the space standards and the planning factors results in approximately 10,000 BGSF per courtroom. In other words, the total area of a 5 courtroom facility should be approximately 50,000 BGSF. Courts that include the relatively large ratio of office departments to court sets, unique grant programs and/or other specialized administrative functions may be larger than 10,000 BGSF per courtroom. Court facilities that are used part-time, have no in-custody holding capacity and/or have no jury facilities may be less than 10,000 BGSF per courtroom. As the number of courtrooms increases, the overall efficiency (by this measure) of the building should increase and should result in a total BGSF that is lower than 10,000 BGSF per courtroom.

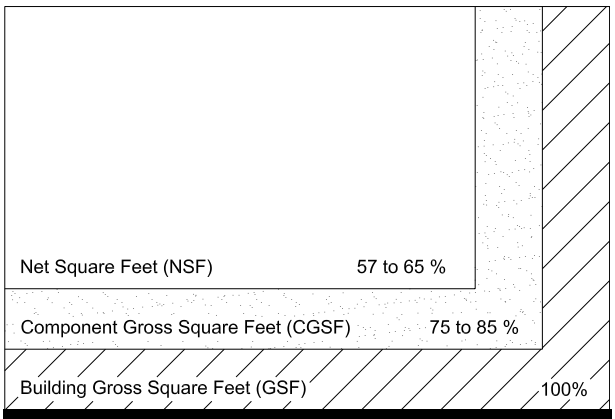


Figure 2.3 Courthouse Efficiency Factors

Relative Building Volume Ratios

The relative building volume ratio for California court facilities shall be in the range of 14-16 when overall building gross area is divided by total building volume and expressed as a resultant. Court facilities typically require higher volume to floor area ratio than office buildings to accommodate the higher ceiling requirements of courtrooms. Additional volume may be required to provide a double height public entry lobby allowing visual orientation to the entries of a majority of public services from the lobby.

Pre-Design Planning Factors for Mechanical and Electrical Equipment Spaces

For pre-planning purposes assume mechanical spaces will require 5 percent to 6 percent of the total estimated building gross. Electrical spaces will require an additional 2 percent of the total estimated building gross. Mechanical and Electrical equipment spaces are considered functional areas that are included in the assignable NSF.

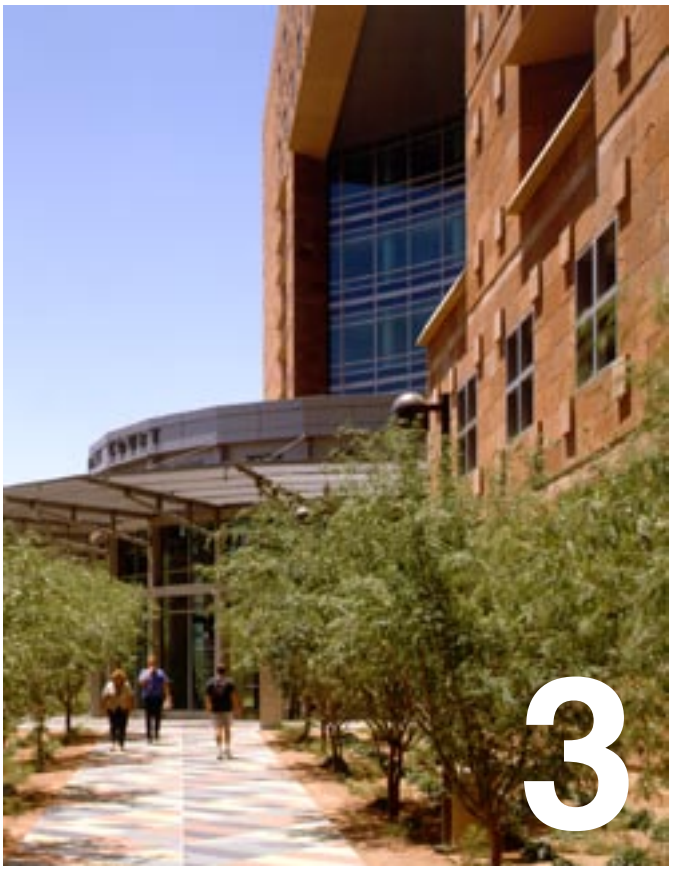
Description	Size (NSF)
Court Set	
Standard Courtroom	1600-1750
Multipurpose Courtroom	2100-2400
Arraignment Courtroom	2100-2400
Chambers (incl. private toilet)	400
Reception/ Waiting/ Files	50-80
Staff/Reception/Wait - 1 person	100-140
Staff/Reception/Wait - 2 person	140-200
Copy/ Workroom/Supply Area	100
Court Reporter's Work Station	64
Research Attorney Work Area	80-150
Staff Toilet Room	60
Jury Deliberation Room	350
Jury Toilet Room	60
Attorney Interview Room	100
Entry Vestibule	64
Law Enforcement Waiting	100
Courtroom Exhibit/Evidence Storage	50
Jury Assembly Facilities	
Entry Queuing Area	14/juror (25% of jury call)
Reception/ Registration	0-300
Jury Assembly Room	12-20 /juror
Forms Counter	5 /juror (10% of jury call)
Coffee and Snack Area	115
Mail Center	60
Call Center	60
Staff Toilet Room	60
Court Administration	
Public Counter Queuing	14 /person
Records Viewing	24 /person
Training Room	360
IS Workroom and Storage	150-300
Active Records Storage	*
Inactive Records Storage	*
Mail Center	150-300
Staff Break Area	150
Lactation Room	50
Private Office	
Executive/Director	240-300
Large	225
Medium	150-175
Small	100-120
Mediator	150
Workstation	
Large	100
Medium	64-84
Small	48
Counter Workstation	40
Conference Room	
Large (16 people)	360
Medium (10 people)	240
Small (6 people)	120
Family Law Facility/Self Help Center	
Waiting	14 /person
Reception/Sign-in	40-60
Orientation Room	150-200
Workshop	375-400
Mediation Room	250-400
Child Waiting	120 + 15 /child
Security Station	50-80
Equipment Storage	100
Alternative Dispute Resolution	
Reception/ Waiting	150
Mediation/ Arbitration Rooms	200-350
Caucus Room	100
Non Court Spaces	
Multipurpose Rooms	150
Attorney Convenience Center	150-300
Volunteer Workstation	50-80
Volunteer Coordinator	100-120

Table 2.2 Space Standards

**Per technology, equipment or code requirements*

Description	Size (NSF)
In-Custody Defendant Receiving, Holding and Transport	
Vehicle Sallyport	1500-2000
Security Vehicle Parking	350
Pedestrian Sallyport	50-100
Holding Cells	40
Control Center	100-250
Central Holding Cells	10 /inmate
Attorney Interview Booth	60-80
Courtroom Holding Cells	40 (1 per courtroom)
Bail/ Fine Payment Counter	48
Storage Rooms	40-100
Public Areas	
Public Queuing Area	14/ person
Weapons Screening Station	250
Information Kiosk or Counter	64
Courtroom Public Waiting	220 ea
Public Toilet Rooms	*
Building Support Services	
Janitor Closet	40
Loading Dock	*
Trash and Recycling Area	80
Media Area	150
Mailroom	160
Staff Toilet with Shower	80
Maintenance Shop	*
Furniture/Eqmt. Storage	*
Telecommunications Equip. Room	150 (min.)
Telecommunications Room	90 per 120,000 s.f. served
Electrical Room	*
Electrical Closet	*
Security Control Room	150-400
Security Equipment Closet	verify
Interior Media Space	150

Table 2.2 Space Standards (continued)



3

SITE DESIGN

Public Entry

Phoenix Municipal Courthouse

Phoenix, AZ

HOK Architects and DMJM Architects

3.1 OBJECTIVES

Court facility site design shall:

- Provide a safe environment
- Provide an accessible environment
- Use landscape to engage and reinforce the architectural design principles.

3.2 SITE SELECTION CRITERIA

The selection of a site impacts the building design, the building's users, and the surrounding area. In order to provide the Courts with the most well-located and thoughtfully sited facilities, the design team must consider:

- Initial and life cycle costs including site development and site purchase;
- Convenience and access to public transportation, major roads, and parking: This may predetermine location in areas with existing infrastructure and transit systems;
- Utility infrastructure;
- Proximity to existing and planned future other justice agencies and detention facilities;
- Visibility and dignity of the location for an important civic building;
- Community and regional context: Local community groups' point of view must be considered in the design process. The siting of the court facility should take into consideration and ideally improve the existing context by complying with local restrictions and planning mandates, such as compatibility with neighboring land use and view corridors.
- Effect on the environment: selection of sites requiring reclamation and cleanup, or sites with historic buildings, may reduce environmental impact and serve as successful examples of reuse.

The selection of an appropriate and successful site will serve the best interests of the Courts, building users, and the community.

3.3 SITE AND BUILDING SECURITY

Balancing security and openness is an essential site design principle. Court facilities must be and appear to be open to those who use them. A building can provide a safe working environment without becoming a fortress, isolated from the community.

The design team must have knowledge of crime trends and the impact to the operational design criteria. Permanent, effective, and visually appealing security planning solutions are the basis of Crime Prevention Through Environmental Design (CPTED). CPTED principles reinforce the ability of design and the built environment to minimize crime and the fear of crime, and improve the quality of life. Apply CPTED principles in site and building master plans and in the early phases of architectural and landscape design.

CPTED Strategies

There are three basic CPTED strategies:

- Natural surveillance: The placement of physical features, activities and people in such a way as to maximize visibility, thus preventing the opportunity of crime (e.g., proper placement of windows overlooking sidewalks and parking lots, using transparent vestibules at building entrances to divert persons to reception areas, etc.). This strategy can be supplemented with the use of security and

police patrols and application of closed-circuit television.

- Natural and constructed access control: Natural access control focuses on limiting and providing guided access through use of properly located entrances, exits, fencing, landscaping, sidewalks and roadways, signage, and lighting, This guidance helps deter access to a crime target and creates a perception of risk to a perpetrator.
- Territoriality: The use of physical attributes that express ownership such as fencing, pavement treatments, signage, and landscaping promotes a perception that these areas are controlled. People in an area that is physically designed to protect designated space are more likely to challenge intruders or report suspicious activity, and causes intruders to stand out.

3.4 INTEGRATION OF BUILDING AND SITE

The following planning criteria shall apply to site design:

Orientation

Consider airflow and microclimate when siting buildings; in hot climates, maintain airflow around buildings to reduce interior temperatures. Avoid creating enclosed areas, which can block airflow. Maximize solar orientation for outdoor seating and to cool the buildings.

- Create spaces for programmed outdoor uses, scaled to the intended activity. Locate outdoor sitting areas and service areas away from building air intake units, to minimize the intake of smoke and exhaust fumes.

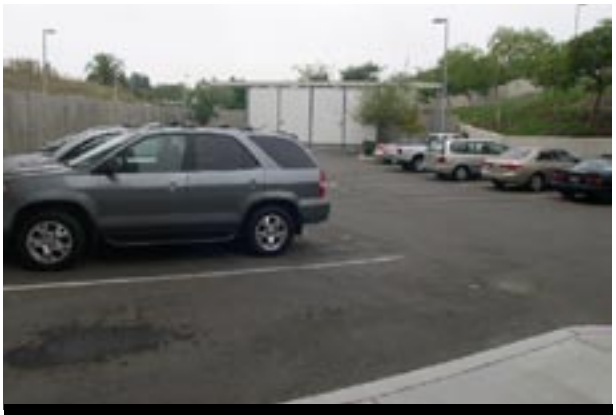


Figure 3.1 Secure Parking, Vista Courthouse

- Orient main entrances of new buildings toward pedestrian areas, to facilitate safe and barrier free access. Orient buildings to take advantage of views, and conversely, new buildings shall not block major view corridors.

Massing

Building shape, size, and scale contribute to a facility's architectural and visual character. To convey human scale, and not overwhelm court users, massing and scale of all new construction shall be considered during planning and design. The following shall apply:

- Building height and coverage must respect local zoning regulations, although such regulations don't strictly apply to State buildings.
- Detail architectural elements of large buildings to maintain a sense of scale and sensitivity to the neighborhood context. Consider the visual and environmental effects that new and existing structures will have on the neighborhood, and on existing buildings located in the sphere of influence caused by shading or reflectance, changes in air flow, and views to and from existing buildings.

Pedestrian Access

Access to and from the courthouse must be safe, convenient, and consistent with universal design principles. If access involves crossing of streets, provide traffic control measures. On extremely busy streets, engage local government in discussion of potential for signalized pedestrian crossing to the courthouse from the parking area.

Building Entrances

Provide a single building entrance for visitors, staff, and the public, to facilitate cost-effective security operations. Provide a separate entrance for judges and bench officers.

- Provide natural or constructed surveillance for building access points
- Building entries must be protected from vehicular threats. See Chapter 4 (Courthouse Security).
- Barrier devices, such as planters and seating walls, shall be functionally integrated into the site and building design.

Site Utilities

Design the location and visibility of utilities to minimize impact on the landscape.

- Service areas and above grade utilities, including backflow preventors, standpipes, gas docks, and emergency generators: Locations shall accommodate long-term maintenance requirements and minimize conflicts with landscape design. Integrate enclosures with or into adjacent buildings; locate away from primary entries. If not possible, cluster components and screen from entries and primary pedestrian paths using appropriate lighting, materials, and planting material.
- Underground utilities, including electrical substations, manholes, controlled environment vaults, and steam service: If possible consolidate under roads, walks, and plazas to minimize impact on the landscape. Locate surface hatches, utility covers, ventilation, and access elements within paved areas. If planted areas are the only option, integrate into shrub and ground cover plantings to conceal their appearance. Conceal vault covers in modular paving areas.

3.5 LANDSCAPING

Provide a related group of landscape materials, to promote continuity throughout the site. Scale and function of landscape materials shall be appropriate to the region, site climate, neighborhood context, security, and functional requirements of a California Courthouse. The following landscape design standards apply:

- Define outdoor spaces consistently and with appropriate scale and function throughout the premises. Use trees and building configuration to shade and provide sound and wind buffering for outdoor spaces and pedestrian areas.
- Design locations and configuration of landscaping features at parking areas so as not to create hiding places.
- Provide shading on southern and western building elevations.
- Accentuate building entries and features with appropriate planting scale and placement.
- Provide visual focus for the public entry and the path to it.
- Provide surface parking lot shading, with a minimum of one canopy shade tree per every 10 parking spaces.
- Configure landscape elements per CPTED strategies.
- Respect sustainable performance goals described in Chapter 1 (General Principles) to reduce maintenance and irrigation requirements by giving preference to regionally appropriate plant species, and using natural strategies to protect and restore water resources.

3.6 PARKING

The transportation contexts in which trial court facilities will be designed and built vary greatly throughout the state and over time. Certain communities limit the amount of parking to shift people into public transit; some communities are not served by public transit. Demand for parking spaces at court facilities is not well documented by empirical studies. Parking in surface lots or structures requires large amounts of land, funds for capital construction operation, and maintenance. The public may equate convenient access to the justice system with easy access to inexpensive parking. Therefore, parking demands and solutions must be carefully considered for each new or expanded court building.

Access to and availability of adjacent public parking for staff, visitors, and jurors must be studied prior to determining how to provide parking for each new or expanded court building. Public transit service to the site must be studied, as parking demand may be

Figure 3.2 Public Entry, Los Angeles Courthouse

correspondingly reduced. Shared parking agreements with adjacent property owners are encouraged, to utilize existing parking with demand times that might be different than for the trial court. In areas where the public typically expects to pay for parking, it is consistent to expect visitors, jurors and staff to pay prevailing rates for parking in adjacent public or privately operated parking lots and structures.

If public parking is provided, calculate parking requirements as follows:

- The number courtrooms and types of matters to be heard.
- Expected public transit use. Staff parking demands can be reduced through traffic-management plans, such as carpooling and public transportation programs.
- The average number of attorneys, visitors, and jurors expected daily; the expected length of stay for each type of parking user.
- Availability of parking within a three to five minute walk from the facility.
- The number of employees at the facility; existing employment agreements regarding provision of parking.
- The average number of official vehicles expected daily at the site.

Limited data gathered by the Office of Court Construction and Management (OCCM) indicates a parking demand, for all courthouse users except judicial officers, ranging from 20 spaces per courtroom for medium to large courthouses up to 45 spaces per courtroom for small courthouses in rural or suburban areas. There is no single standard for parking.

Provide secured parking adjacent to or within the courthouse for each judicial officer, the court executive officer, and a small number of staff that may require secured parking. Secured parking in surface lots shall be fenced, visually screened, and separated from public circulation pathways and parking. If secured parking is provided beneath the courthouse, separate restricted elevator access from the secure parking area to restricted court spaces shall be provided. Other requirements for vehicular access to security areas are provided in Chapter 4 (Courthouse Security).

Parking spaces, except for accessible van spaces, shall be standard size, seven-feet six-inches, by 18-feet. Provide 25-foot wide drive aisles for double-loaded 90-degree layouts. Parking space depth can overhang a planting area by one-foot six-inches.

Provide a loading zone for delivery vehicles that do not need to use the loading dock, or where a loading dock is not provided. However, all in-coming packages delivered shall go through security screening, consistent with the court security operations plan.

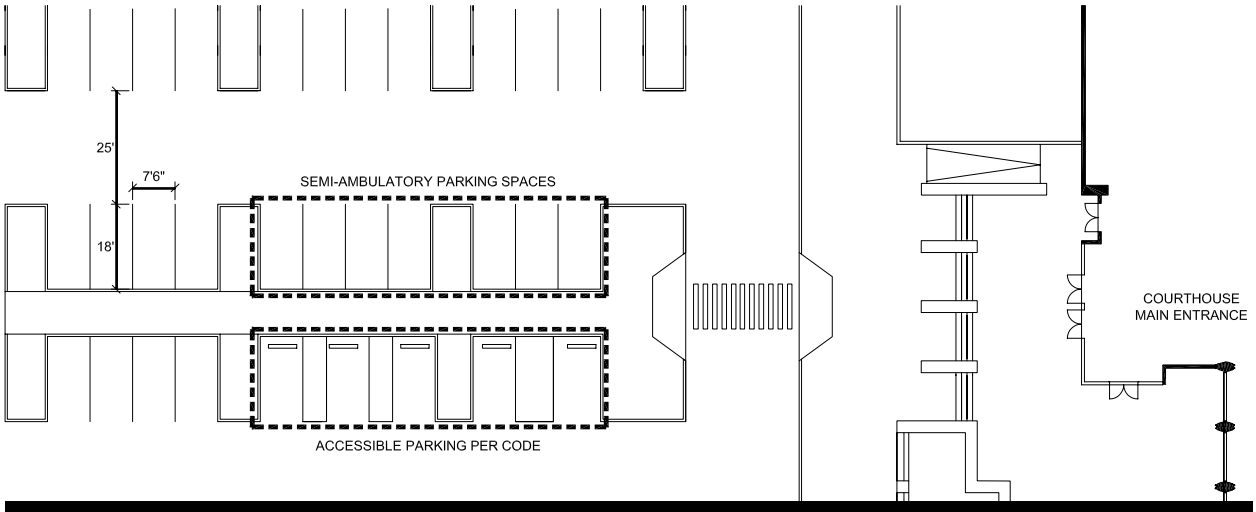


Figure 3.3 Parking Layout Showing Location of Accessible and Semi-Ambulatory Spaces

4

COURTHOUSE SECURITY

Public Waiting Area

Phoenix Municipal Courthouse
Phoenix AZ
HOK Architects and DMJM Architects

Courthouses must be a safe harbor to which members of the public come to resolve disputes that often are volatile. Once courthouses themselves are perceived as dangerous, the integrity and efficacy of the entire judicial process is in jeopardy.

Ronald M. George,
Chief Justice of California

4. COURTHOUSE SECURITY

Courthouse security planning must ensure a safe and secure environment for the staff and public, and protect the functions and assets of California court facilities. Balancing security and openness in civic buildings presents many challenges. Security planning and design must anticipate terrorist events, chemical and biological attack, natural disasters, emergencies, power outages, crime, and workplace violence. Building systems shall be designed and maintained to protect public health and life safety, and provide direct egress routes for rapid and safe evacuation of building occupants to the outside. These guidelines represent best practices to maximize public security and personal safety. The security planning process is most effective when integrated into the courthouse design at an early stage.

See Chapter 8 (In-Custody Defendant Receiving, Holding, and Transport) for security relating to in-custody defendants.

See Chapter 17 (Telecommunications and Audiovisual Design Criteria) for electronic systems infrastructure.

4.1 OBJECTIVES

Courthouse security planning and design shall:

- Ensure a safe and secure environment for all building occupants
- Maintain continuous operations until building inhabitants can evacuate to a safer area
- Provide security and confidentiality of critical information
- Enable security and court personnel to maintain control during normal and disrupted operations

4.2 DESIGN, TECHNOLOGY AND OPERATIONS

A comprehensive court facility security plan integrates

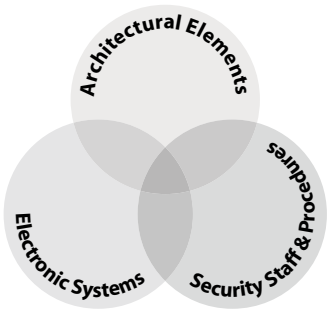


Figure 4.1 Security Plan Elements

design, technology, and operations, including policies, procedures, and personnel. The most effective security plan is achieved when these three elements are coordinated during early project phases.

- Design: Design includes architectural elements and engineering systems, including space planning, adjacencies, user group zoning, passive physical protection; doors, locks, site perimeter barriers; exterior lighting, egress and circulation, and all building systems relating to building evacuation.
- Technology: Technology includes electronic security systems and equipment, such as automated access controls, alarm monitoring, duress alarms, remote door and gate controls, closed circuit television (CCTV), and cameras.
- Operations: Operations refers to policies and procedures for the court facility, and those applied for security program management, security staffing, and employee training.

This chapter addresses design and technology planning criteria. When developing a facility security plan, the project team must understand the essential role of operations and staffing levels, because they are directly related to the ability to provide a safe environment, and impact annual operating costs and budgets.

Security planning must consider and reflect security staffing levels at each facility. The project team shall develop a comprehensive plan with courthouse security personnel to understand operating policies, procedures and projected security staffing levels. Technology and electronic systems shall be coordinated with architectural and engineering systems, and building operations.

4.3 FACTORS AFFECTING SECURITY LEVELS

New court facilities vary in size, complexity, types of cases handled, threats and geographic location. Court facilities may, in some instances, be co-located with other public or private uses. Potential risks or threats include:

- Size of court operation: Loss of the use or destruction of a large facility, containing over 50 courtrooms, would have a significant impact on the courts and the community.
- Types of cases: Family Courts have a high risk of confrontation, assault, and violent behavior. Criminal Courts require security measures to ensure safe handling of individuals in detention.
- Threats: Past history of incidents or threats may be interpreted as a site-specific increased risk factor. Intelligence from local police, California Highway Patrol, and the Federal Bureau of Investigation, shall also be considered.
- Location: Adjacent facilities, such as federal and public buildings, symbolic targets, and landmarks, may pose a threat to a court facility. High-crime neighborhoods, as identified by crime risk survey data, may result in increased security risks. Measures may be required to mitigate substandard site characteristics such as lack of building setback distances, limited parking arrangements, and sightlines from adjacent buildings or landscapes into chamber windows.

Capability to Increase Security

The facility must accommodate changes in security requirements. For example, if a high profile or celebrity case is assigned to a court located in a small county, security needs may temporarily increase to levels higher than normally encountered. National, regional, and local conditions and threat levels may also impact security requirements. Examples of increased security during heightened threat and alert levels include: escalating screening capacity in the lobby and increasing building setback distances to protect against vehicular threats.

Courthouse Risks

Identifying risks and threats to the court facility enables the project team to determine appropriate security design elements and countermeasures to mitigate potential risk and damage. Security risks for new courthouses include*:

- Violent or assaultive behavior directed against staff, judicial officers, the public, or detainees
- Damage to physical facilities
- Theft of property, including money
- Disruption of court activities
- Compromise of court process, including evidence, court records, jury sequester, and due process

4.4 THREAT ASSESSMENT PROCEDURE

Qualified persons for each project shall conduct a Threat Assessment during architectural programming. Refer to Figure 4.2 (Threat Assessment Flow Chart). The Threat Assessment shall consider the likelihood of an attack occurring and the consequences. Consequences are the tangible and intangible costs, including capital and operational costs, if an event were to happen. The Threat Assessment procedure is as follows:

- During the early project planning phases, before architectural programming or site selection occur, the principles and security measures described in this chapter and in Table 4.1 (Security Standards) shall identify the preliminary scope of security design elements for the site and building.
- A Threat Assessment report summarizing findings and recommended mitigation measures shall be

**Source: The National Center for State Courts*

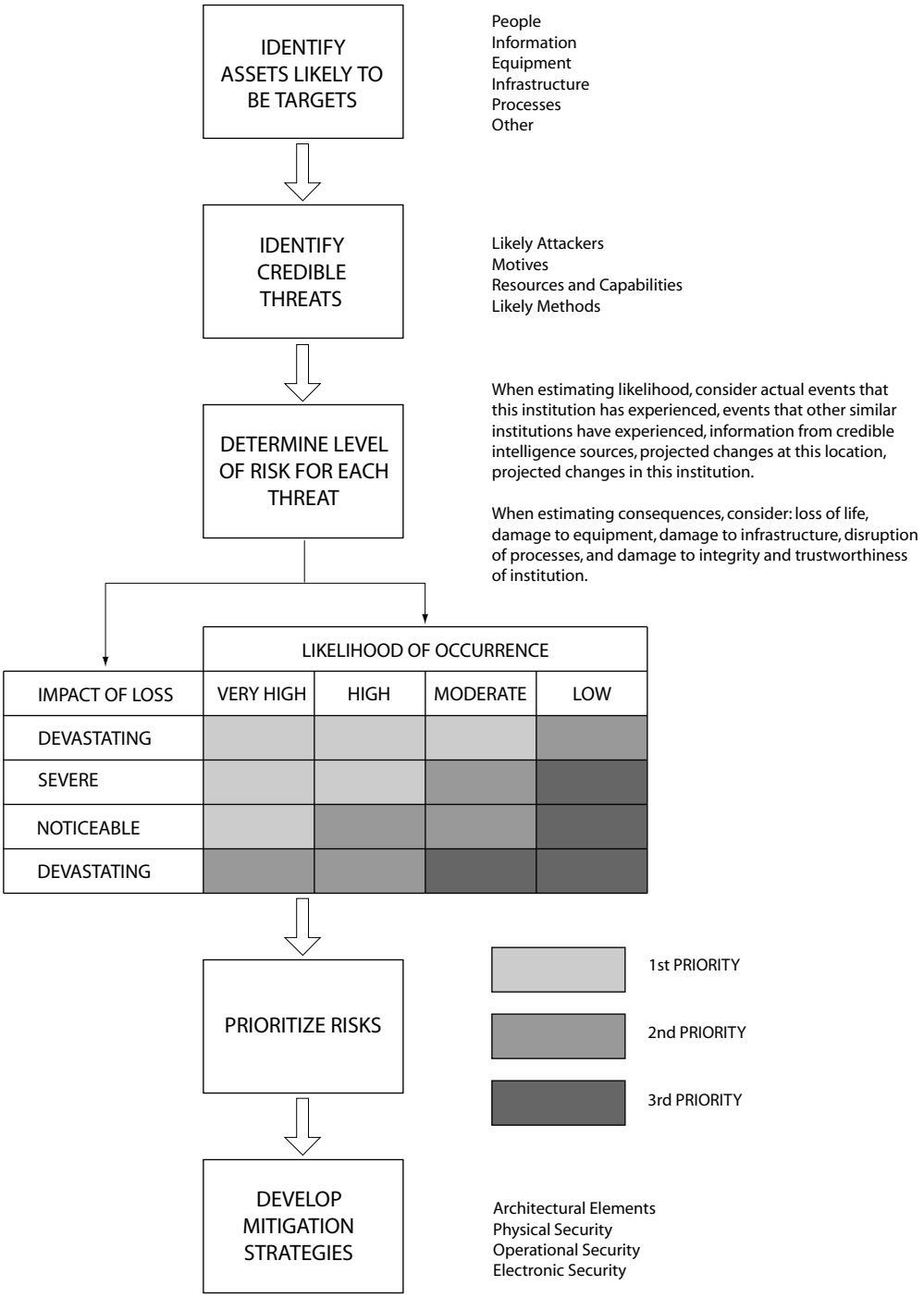


Figure 4.2 Threat Assessment Flow Chart

prepared prior to completion of the architectural program. This report shall discuss proposed project security elements, including the rationale for proposals that exceed or do not meet the Facility Standards.

- Upon review of the Threat Assessment, the project team shall identify site and building security requirements required for the project, including definition of the project setback distance.

4.5 SECURITY PLANNING CRITERIA

The following security planning criteria represent best practices, and shall apply to all court buildings.

Site Selection and Design

Vehicular and adjacency threats may be a major concern at court facilities, and must be considered during site selection and site design.

- Maximize the setback between vehicular roadways and buildings, at a minimum of 20 feet. Setback is the distance maintained between a structure or asset and the potential location of the threat. This is measured from the secured perimeter to the face of the structure. Increasing setback distance greatly improves protection for the building and occupants, as blast pressures decay exponentially with distance. Every foot of setback distance is critical.
- Site the building so street configurations do not create a straight, head-on approach to the facility, and adjacent facilities and functions do not pose significant risks or threats.

Parking Security

- Public parking shall not be allowed within or beneath the courthouse, or directly adjacent to the courthouse. Place public parking and drop-off zones outside the defined setback distance.
- Underground secure parking for judges and limited court staff requires a screening area before car entry. The number of vehicular access points into secure parking areas must be minimized and controlled with openable barriers. Harden primary walls and floor systems surrounding these areas. Use circular columns with spiral reinforcing. Design columns to resist a package weapon, and design for a two-story unbraced length. Separate high-risk and critical or occupied areas by at least 25 feet, or design walls and floor slabs that separate high-risk and critical or occupied areas to resist a package weapon threat.
- Exterior secure and service parking areas adjacent to the courthouse require openable barriers at entries. Place controlled parking areas between the building and uncontrolled streets. Place on-site parking as far from the building as possible; re-

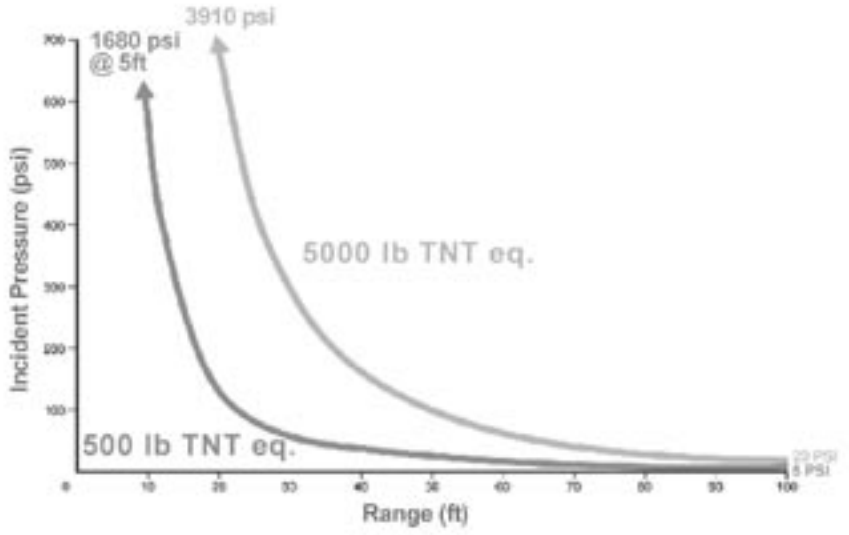


Figure 4.3 Diagram Showing Blast Decay With Distance *Source: Hinman Consulting Engineers*

duce or eliminate adjacencies between occupied or critical areas and spaces accessible to vehicles.

- Co-locate loading dock and parking garage entries.
- Provide CCTV surveillance with recording at all entries and exits, including vehicle gates. In multi-level parking structures, provide CCTV surveillance and emergency telephones. Monitor and response capability is required.

Site Security

- Employ CPTED principles.
- Place any trash receptacles or public mailboxes outside the setback distance.
- Illuminate site perimeters, walkways and drives.
- Restrict heights of landscaping to maintain natural surveillance.
- Protect utilities (gas, power, telephone) at entrance to the site.
- Employ physical barriers to maintain setback distances, enhance perceived protection and create a perception of the courthouse as a hard target. The design team must select a barrier that will stop a vehicular threat as identified in the Threat Assessment. Consider traffic pattern and flow relative to the site configuration.
- Provide CCTV surveillance of building entrances.

Building Layout

The building shall be planned to minimize vulnerabilities through appropriate space planning and adjacencies. If hardening of floors and walls is required by the Threat Assessment:

- Provide one staff and public entrance point. An additional staff entry may be provided if a entry is staffed and screened at beginning, lunch and end of each workday. Provide a secure path from the judges' secure parking area to judges' chambers.
- Separate high-risk areas, including unscreened lobby, loading docks, mailrooms, and the parking garage, from occupied spaces, critical utilities and building systems needed to ensure rapid and safe building evacuation, including electrical, mechanical and fire protection equipment. Do not place critical utilities at exterior walls or within 25 feet of high-risk areas. Do not place occupied areas within 25 feet of high-risk areas.
- Locate emergency generators at least 50 feet from the primary electrical source
- Co-locate loading dock and mailroom towards the building exterior
- Locate all emergency egress away from high-risk areas. Provide redundant emergency egress exits but do not cluster routes.
- Place unoccupied spaces at the lower perimeter levels.
- Stack critical areas and supporting utilities.
- Provide ductile materials in emergency egress pathways to minimize debris.

Courtrooms

- Provide silent duress alarm buttons for judge, bailiff, and clerk.
- Provide bullet-resistant panels within podium/ bench for judge, bailiff, and clerk.
- Provide CCTV surveillance of the courtroom including well area and public seating.
- Provide audio surveillance (microphones) of courtroom.
- Provide lock-down capability for courtroom exit doors.
- Minimize windows with direct line of sight from public areas, circulation zones, and parking garages, to prevent observation of activities, threat exposure, or communication with courtroom occupants.
- Provide gunlocker in bailiff station.

Chambers and Jury Deliberation Rooms

- Provide silent duress alarm buttons for judge and clerk.
- Minimize windows with direct line of sight from

public areas, circulation zones, and parking garages, to prevent observation of activities, threat exposure, or communication with courthouse occupants.

Payment Counter, Court Clerk Offices and FCS Mediator Offices

- Provide silent duress alarm buttons and CCTV surveillance.

Lobby and Waiting Areas

- Provide only one public entrance, to reduce operational screening requirements.
- Eliminate trash, mail receptacles or other areas of concealment in the unscreened lobby areas.
- Provide duress alarms, magnetometer, and package weapons scanner at screening stations.
- Design lobby to accommodate direct visual surveillance by staff and security officers.
- Design lobby for increased levels of security; this may include additional screening areas or restriction of openings into secure areas.
- Limit adjacencies between occupied and unsecured spaces.
- Physically isolate vulnerable areas, such as lobbies and delivery areas. Place unsecured lobby areas outside the main structure, or in the exterior bay. Based on the Threat Assessment, the following may be required: harden walls of an unsecured lobby to resist detonation of a package or backpack weapon located 10 feet away; harden the floor above unsecured lobby areas to resist a backpack explosive located at the floor level.
- In high-crime neighborhoods, provide CCTV surveillance of lobby and secured areas of buildings.

Current Case File Storage Areas, Evidence Storage Rooms

- Limit access to authorized personnel; locate adjacent to secure corridor; provide keypad.
- Provide smoke detection devices; consider fire suppression systems that minimize water damage to contents deemed essential to judicial operations.

Loading Dock and Mailroom

- Provide CCTV surveillance and silent duress alarm button.
- Design loading dock area with ability to be physically secured.
- Provide space and a driveway arrangement to permit manual screening of delivery trucks.
- Place loading docks and mailrooms exterior to the main structure or in the exterior bay. If not possible screen incoming packages and mail at a remote facility. Locate critical and occupied space at least 25' away from the loading dock and mailroom, otherwise harden.

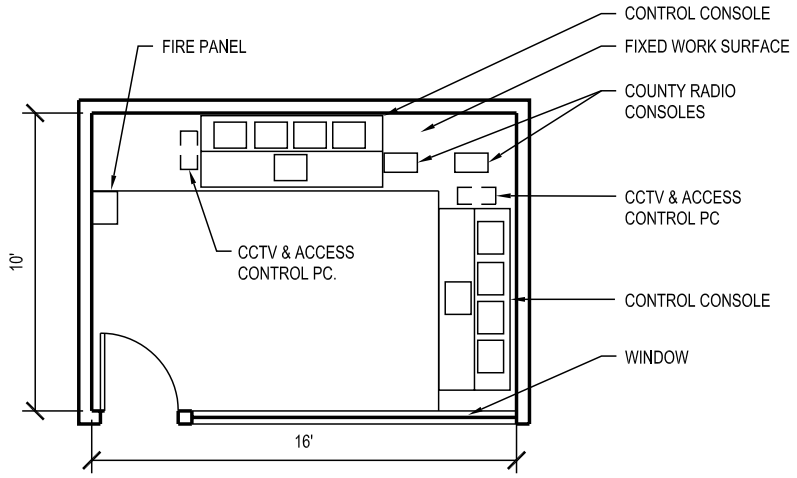


Figure 4.4 Plan of Security Control Station

- Provide package weapons scanner in the mail-room.
- Provide blast resistant storage container at screening areas for suspicious packages.

Security Control Center

A centrally located security control center shall be provided, to operate and monitor electronic security systems. This space is not required in small court facilities.

- The security control center may duplicate functions from the in-custody defendant holding control room, or may be combined with the holding control room. Chapter 8 (In-Custody Defendant Receiving, Holding and Transport) describes systems that operate from the security control center.
- Fire control centers, required with high-rise life safety systems, shall remain separate from the security control center.

Security Equipment Closet

Provide a main security equipment closet adjacent to the building security control center and telecommunications closet.

- The security equipment closet shall be an air-conditioned space with network drops and emergency power circuits. Provide a dedicated HVAC system that operates 24/7.
- Locate at least one secondary security equipment closet on every other floor to accommodate security equipment, wiring, pull cans, and terminal cabinets. This may be combined with the technology closet.
- Secondary security equipment closets shall be located directly above or below the main security equipment closet.
- Closet space shall be sized to 125 percent of equipment capacity.

Building Envelope

The exterior building envelope shall be designed to minimize vulnerabilities and protect occupants from flying debris entering the building in the event of a blast. Depending on the Threat Assessment, prescriptive systems or performance design to harden the façade may be required. If building hardening is required, the façade shall resist a 4-psi and 28 psi-msec air-blast loading. These criteria require that exterior glazing be designed for defined air-blast loads and mullions.

- Doors: Lock and monitor all unscreened perimeter doors. Provide intrusion alarms to monitor perimeter doors and sensitive areas after-hours.
- Windows: Limit or eliminate operable windows.
- Limit building envelope fenestration at critical areas such as courtrooms, chambers and jury deliberation rooms, especially at the first level.
- Minimize blast effects by using convex shapes and limited re-entrant corners.
- Provide bulletproof glazing at chambers.
- Provide forced entry protection at the first floor.
- In high-crime neighborhoods or where a local threat has been identified by the Threat Assessment, eliminate provide motion sensors and glass-break detection in building areas accessible from grade. Provide CCTV surveillance of building exterior.
- If required by the Threat Assessment, use laminated glass and frames designed to meet security needs.
    - Glass: The innermost pane of all exterior glass shall be laminated. From inside to outside, the typical glazing system shall consist of: ¼-inch laminated annealed glass, with 30-mil inner layer, ½-inch air gap, and ¼-inch monolithic annealed glass. Ideally, the glass pane shall be as weak as possible, so as not to transmit additional load to the frames, mullions, and anchorage. Structural silicone sealant shall be used along the exterior perimeter of the pane to adhere the glass to the frame. Monitor with an intrusion alarm system.
    - Mullions, Frames and Anchorage: Frames and anchorage shall be designed to resist the maximum capacity of the glass. This approach creates a balanced design in which

the weakest element, the glass, fails first and creates a controlled, instead of catastrophic, failure of the system. Aluminum or steel mullions are preferred. Typically, curtain wall systems, including unitized systems, can be modified with deeper or thicker sections than generally used. A clear load path, incorporating balanced design, must be provided from the glass to the primary structure.

- Walls: Use ductile systems that resist the defined loads or are designed to support the windows, and will minimize flying debris entering occupied spaces.

4.6 STRUCTURAL SYSTEMS

Protective structural design ensures building occupants will be able to evacuate the building safely and rapidly during an emergency, especially if part of the building is damaged, destroyed, or subject to a blast. The goal is to avoid progressive collapse, by designing a structure that will not collapse if one or more structural members are damaged, fail, or are destroyed.

- Minimize floor-to-floor heights. The limit is generally less than or equal to 16 feet.
- Minimize column bay spacing, especially at the exterior bays. The upper limit for column spacing is generally 30 feet.
- Avoid overhangs with occupied space above.
- Provide redundancy and alternative load paths to mitigate blast loads.
- Minimize horizontal and vertical structural irregularities.
- Provide balanced design of structural components.
- Prevent single-point-of-failure of the building structure by limiting or avoiding large transfer girders.
- Select a ductile structural system, similar to that required for seismic design. Acceptable structural systems include moment frame steel structures, steel frames with shear walls, and reinforced concrete systems with ductile detailing. Moment frames shall be located at the exterior bays of a building for resistance to progressive collapse. Floor slabs above high-risk areas must be designed for upward forces by using continuous, symmetrical reinforcement at the top and bottom. Ensure that bottom reinforcing is continuous at the roof system beams and slabs. Use ductile detailing for connections, especially primary structural member connections.
- Control deflections around certain members, such as windows, to prevent premature failure. Additional reinforcement is generally required.
- At areas separating unscreened and occupied court areas, harden floor systems to resist detonation of a package or backpack explosive located at the floor level and one structural bay away.
- Use circular columns with spiral reinforcing in the building structural system.
- Design structural columns in high-risk areas to resist a package explosive located 3 feet away.
- Use one-way wall elements spanning from floor-to-floor to minimize blast loads imparted to columns.
- Concrete masonry unit (CMU) walls shall be fully grouted and reinforced, with connections designed to allow full development of capacity at the supports.

4.7 MECHANICAL, ELECTRICAL, AND FIRE PROTECTION SYSTEMS

Mechanical, electrical, and fire protection systems are critical security elements that must remain functional at all times. These systems, like structural elements, ensure that building occupants are able to evacuate the building safely and rapidly, especially during an emergency.

Critical systems include fire protection, air-handling units to evacuate smoke, emergency communications systems, emergency lighting, especially at means of egress, and emergency power to ensure these systems are functional in the event of a power outage.

- Locate critical utilities far from high-risk areas. Do not install utilities within 25 feet of parking areas, unscreened lobby, loading docks, and mailrooms. Stack critical areas and their supporting utilities.

- Locate transformers and emergency generators away from high-risk areas and below grade. Locate emergency generators at least 50 feet from the primary electrical source; if emergency located adjacent to high-risk areas, harden the intermediate floor and wall systems.
- Avoid routing critical utilities next to parking areas. If this cannot be avoided, consider encasing in concrete.
- To mitigate a chemical or biological attack within the building, locate air intakes at least 48 feet above grade or as high as practical. If air intakes are placed on the roof, secure all roof access points.
- Protect critical utilities including service entrances.
- Locate main and back-up systems as far apart from each other as possible, a minimum of 50 feet
- Isolate mailroom HVAC zone to prevent circulation into main building.
- Provide system to purge mailroom in case of biochemical contamination.
- Provide redundancy of critical systems. Place back-up systems and distribution as far from primary systems as possible.

4.8 ELECTRONIC SECURITY SYSTEMS

Electronic security systems shall be coordinated with building systems, and reflect the evolving needs of the facility. Security systems shall be integrated with each other and utilize the court's local area network. Security electronics systems shall include:

- Access control: Provide building perimeter protection and controlled separation between public, staff, in-custody areas, and other critical areas.
- Closed Circuit Television (CCTV): Provide high-definition color cameras in each courtroom, with audio monitoring capability, digital video recording, and storage for all cameras.
- Alarm monitoring: Provide monitoring of duress alarms, intrusion alarms, and evidence storage area alarm.
- In-custody transportation and holding areas: Provide remote door control and monitoring, intercom system, operator control panels, and CCTV cameras.
- Other systems: Provide security monitoring and control room, emergency telephones, metal detection, package scanning, secure parking controls, and audio-video monitoring of courtroom proceedings.

Infrastructure Requirements

The design team shall coordinate:

- Installed systems infrastructure
- Future systems infrastructure
- Pathway and space requirements
- Door hardware
- Egress routes shall not cross secure perimeters
- Elevator control
- Telephone and data rooms
- Card access control
- Security control room
- Monitoring and control equipment for all building security systems
- Movement control for in-custody defendants
- Remote door and gate control

Security Standards	Com-pliance
Manditory	M
As Determined by Threat Assessment	TA
Site Selection	
Maximize setback distance to street or adjacent buildngs	M
Locate building to minimize adjacency and configuraion risks	M
Parking Security	
Restrict public parking locations in proximity to court building	M
Restrict and control secure parking locations	M
Co-locate parking garage and loading dock entries	TA
Provide CCTV at parking entries and exits	TA
Site Security	
Employ CPTED principles	M
Place trash receptacles and mailboxes outside the setback distance	M
Illuminate site perimeters, walkways and drives	M
Restrict height of landscaping	M
Protect utilities (gas, power, telephone, etc.) at entrance to site	M
Provide physical barriers to maintain building setback distance	TA
Provide CCTV camera surveillance of site	TA
Building Layout	
Provide only one public entrance	M
Provide a secure path between Judges' parking and chambers	M
Separate high risk areas from occupied spaces, and critical systems, utilities and egress	M
Colocate loading dock and mailroom towards the building exterior	M
Place unoccupied spaces at the lower perimeter levels	TA
Stack critical areas and supporting utilities	TA
Courtroom	
Provide silent duress alarm buttons for judge, bailiff, and clerk	M
Provide bullet-resistant panels within podium/ bench for judge, bailiff, and clerk	M
Provide CCTV camera surveillance	M
Restrict windows with the line of sight into courtroom	M
Provide gunlocker in bailiff station	M
Provide audio surveillance (microphones) of courtroom	TA
Provide lock-down capability for courtroom exit doors	TA
Judges Chambers	
Provide silent duress alarm buttons for judge and clerk	M
Restrict windows with the line of sight into chambers	M

Figure 4.1 Security Standards

Provide bullet resistant glazing	TA
Jury Deliberation Room	
Provide silent duress alarm buttons	M
Restrict windows with the line of sight into jury deliberation room	M
Payment Counter, Court Clerk Offices and FCS Mediator Offices	
Provide silent duress alarm buttons	M
Provide CCTV camera surveillance	M
Lobby and Waiting Area	
Provide only one public entrance	M
Eliminate potential areas of concealment in the unscreened areas	M
Provide duress alarms, magnetometer and package weapons scanner at screening station	M
Design lobby to accommodate direct visual surveillance by staff and security officers	M
Design lobby to allow increased levels of security	M
Provide barriers between lobby and secured areas of building	TA
Physically isolate unscreened lobby area	TA
Provide CCTV camera surveillance of lobby and secured areas of building	TA
Current Case File Storage Areas, Evidence Storage Rooms	
Locate adjacent to restricted corridor; provide key pad	M
Provide appropriate fire protection devices	M
Loading dock/ Mailroom	
Provide CCTV camera surveillance and silent duress alarm button	M
Design loading dock with ability to be physically secured	M
Provide space and driveway arrangement to permit manual screening of delivery trucks	M
Physically isolate the loading dock	TA
Locate critical and occupied space at least 25’ away from loading lock/ mailroom or harden	TA
Provide package weapons scanner in mailroom	TA
Provide blast resistant storage container for suspicious packages	TA
Security Control Center	
Maintain separation of the fire control centers and security control	M
Provide control center to operate and monitor electronic security systems	TA
Duplicate functions of in-custody holding control room	TA
Security Equipment Closet	
Locate adjacent to the building security control center and IT closet	M
Provide a dedicated, 24/7 HVAC system	M
Provide at least one secondary security equipment on every other floor	M
Size closets to 125% of equipment capacity	M
Building Envelope	
Exterior doors shall be locked and monitored by intrusion alarm system	M

Figure 4.1 Security Standards (cont.)

Minimize/ eliminate operable windows	M
Limit windows at critical areas	M
Provide bulletproof glazed windows at chambers	TA
Provide forced entry protection at the first floor	TA
Monitor exterior glass with intrusion alarm system	TA
Provide blast resistant laminated glazing and mullions to meet security requirements	TA
Structural Systems	
Minimize floor-to-floor heights	M
Minimize column bay spacing	M
Avoid overhangs with occupied space above	M
Limit or avoid large transfer girders	M
Provide redundancy and alternative load paths to mitigate blast loads	M
Provide balanced design of structural components	M
Use ductile structural systems	M
Control deflection, especially around windows	M
Harden floor and/or walls to resist package or backpack blast	TA
Use circular columns with spiral reinforcing	TA
Design structural columns to resist a package explosive located 3 feet away	TA
Use one-way wall elements spanning from floor-to-floor	TA
Concrete masonry unit (CMU) walls shall be fully grouted and reinforced, with connections designed to allow full development of capacity at the supports	TA
Mechanical, Electrical, and Fire Protection Systems	
Locate critical utilities far from high-risk areas	M
Locate emergency generators at least 50 feet from the primary electrical source	M
Avoid routing critical utilities next to parking areas	M
Protect air-intakes	M
Protect critical utilities including service entrances	M
Locate main and back-up systems as far apart from each other as possible, a minimum of 50-feet	TA
Isolate mailroom HVAC zone	TA
Provide mailroom purging system	TA
Provide redundancy of critical systems	TA
Electronic Security Systems	
Provide access control between public, restricted and secure areas	M
Provide electronic perimeter protection	M
Provide monitoring of intrusions and duress alarms	M
Provide door control and remote monitoring of in-custody transportation and holding areas	M
Coordinate current and future infrastructure and control systems	M
Provide CCTV and audio monitoring in courtrooms	M

Figure 4.1 Security Standards (cont.)

5

COURT SET

Trial Courtroom

San Francisco Civic Center Courthouse
San Francisco, CA
RossDrulisCusenbery Architecture
Hood-Miller Associates
Mark Cavagnero Associates/ John M.Y. Lee

5. COURT SET

The court set includes courtrooms, judicial offices, subsequently referred to as chambers, chambers support space, jury deliberation room, witness waiting, attorney conference rooms, evidence storage, and equipment storage. A restricted corridor, with staff elevator and stair system, connects the chamber suites, staff offices, and secure parking. Specific project requirements are developed during the programming phase, consistent with area requirements described in Chapter 2, Courthouse Organization.

5.1 OBJECTIVES

The courtroom is the focal point of the state's judicial process. The courtroom provides the formal setting for conducting the business of the court and is the primary place where judicial officers, court staff, attorneys, and litigants or defendants interact. Traditionally, the courtroom accommodates the judicial officer (judge, commissioner, or hearing officer), court clerk, reporter, bailiff, parties, attorneys, witnesses, jury, and spectators. Special purpose courtrooms may include some variation of this group.

- Ensure the parties in any proceeding are able to see and hear the witness, jury, judicial officer, and counsel
- Protect witnesses and jurors from intimidation

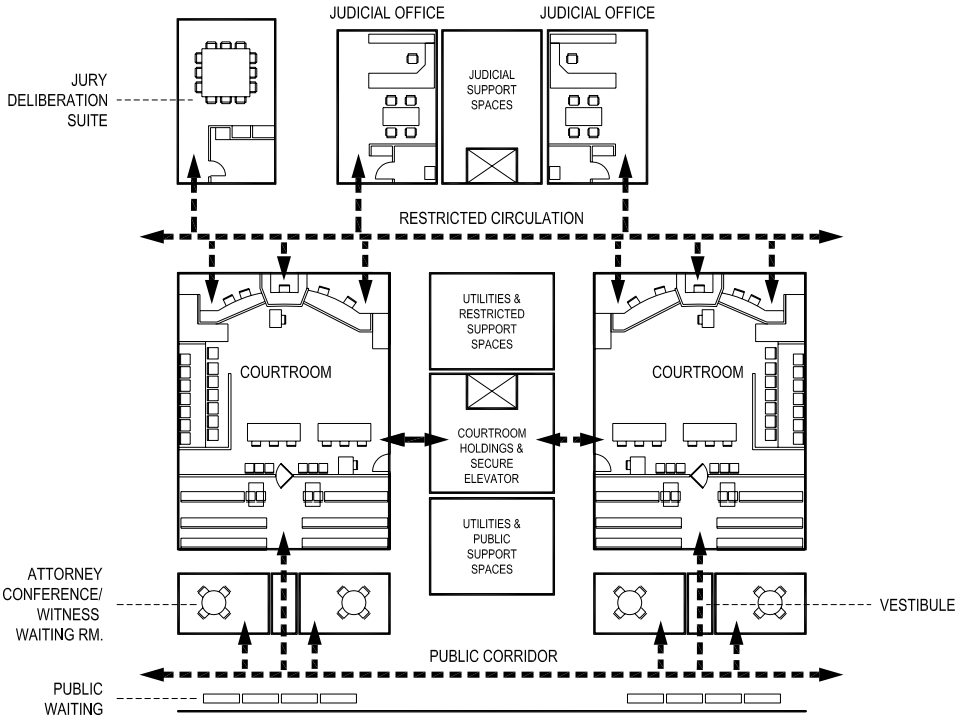


Figure 5.1 Typical Court Floor Organization

- Provide reasonable confidentiality for attorneys, defendants, litigants, and judicial officers
- Provide full accessibility to all raised platforms
- Design all spaces with sufficient flexibility to allow future change in court operations.

5.2 COURTROOM

Basic Courtroom Types

Provide courtrooms that can function for a range of judicial proceedings. The Facility Standards define three sizes of courtrooms:

- Multipurpose Courtroom: 1,600 – 1,750 net square feet (NSF): The multipurpose courtroom is the typical trial courtroom in California. It is sized and configured to offer facilities for a variety of judicial matters, including criminal, civil, law and motion, and public hearings. The multipurpose courtroom is sized to accommodate a jury box and other courtroom components. Refer to Figures 5.22-5.23 for examples of multipurpose courtroom layouts.
- Large Courtroom: 2,100 – 2,400 NSF: The large courtroom is larger than the multipurpose courtroom and is sized for high volume, high profile, and multi-litigant cases such as traffic or construction defect cases; it can also be used for special proceedings supporting court operations. Refer to Figures 5.24-5.26 for examples of large courtroom layouts.
- Arraignment Courtroom: 2,100 – 2,400 NSF: The arraignment courtroom is the same size as the Large Courtroom. An arraignment is a court appearance in which the defendant is formally charged with a crime and asked to respond by pleading guilty, not guilty or nolo contendere. Other matters handled at the arraignment include arranging for the appointment of a lawyer to represent the defendant, and setting bail. The courtroom must have a connection to secure holding circulation to accommodate large numbers of in-custody defendents.. There is no jury box. Refer to Figures 5.27-5.29 for examples of arraignment courtroom layouts.

Special Courtrooms

There may be exceptions for special court operations, such as juvenile, mental health, domestic violence, high security and drug courts, which require alternate fixtures or special configurations within the boundaries of multipurpose or large courtrooms.

Courtroom Entries

All courtrooms, regardless whether in-custody proceedings occur, require three distinct points of entry:

- Public, for spectators, attorneys, parties, witness, and press through a vestibule from the public corridor.
- Restricted, for judicial officers, jurors, court personnel, and designated court participants through two doorways from a restricted court staff corridor.
- Secure, for prisoners, detention officers, and bailiffs through a controlled and secure entry near the bailiff's station and defense attorney table from the secure circulation system.

Courtroom Adjacencies

- Locate courtrooms adjacent to court floor holding cells (or area reserved for the future addition of secure holding cells). In some instances, multipurpose courtrooms are used for civil proceedings and do not require access to court level holding facilities.
- Locate courtrooms for easy access from judicial chambers. Group judicial chambers and related support space adjacent to the restricted corridor, providing judges and staff quick courtroom access.

CourtroomType	Square Feet	Spectator Seating	Structural Bay Width
Multipurpose	1,600 - 1,750	45 - 48	32' - 36'
Large	2,100 - 2,400	96 - 100	32' - 36'
Arraignment	2,100 - 2,400	96 - 100	32' - 36'

Table 5.1 Courtroom Types

- Courtrooms may be assigned to an individual judge. When courtrooms are not dedicated for use by one bench officer, chambers can be located remote from the courtroom.
- If chambers are co-located remote from the courtrooms, such as on adjoining floors, a robing room and conference area may be necessary adjacent to the courtroom.

Corner Bench or Center Bench Layouts

California courtrooms may use either a corner or center bench configuration. Each offers different design and operational opportunities. Selection of either is a project decision, to be based on the following design and operational criteria:

- Optimum sight lines among the judge, jury, attorneys and witness
- Ease of accommodating two courtroom clerks
- Ability to move paper documents between clerk and judge
- Sightlines to projected images
- ADA accessibility to the bench, other raised platforms and areas of courtroom
- Dignity and formality
- Accommodation of courtroom technology and computer equipment
- Space efficiency

5.3 COURTROOM ACCESSIBILITY

Floor levels of courtroom components vary. Maintaining sightlines among all components, while providing full accessibility, shall be a priority. The accessible path of travel to the judge's courtroom workspace (bench), courtroom clerk's workspace, witness stand, and jury box must address the recommended floor heights discussed in Table 5.2 (Court Component Information). Separate paths of travel for persons with disabilities shall be avoided. The judge's circulation path must never be in front of the bench. Level changes can be achieved as follows:

- Ramps are the preferred solution for providing universal access and operationally functional spaces. However, a long ramp may be required in the restricted corridor, or the restricted corridor elevation must be constructed at least one step higher than the primary courtroom floor elevation.
- Ramps to the witness area, the clerk at courtroom floor level, and a two-stop lift to the judicial officer's bench are another approach. A multipurpose courtroom litigation area may accommodate up to 18 people, along with exhibits and a courtroom reporter. Ramps to the courtroom clerk, witness stand, and the first level of the jury box shall not create a hazard within the well, and not encroach into the litigation area.
- A three-stop lift to the witness and judge's levels of the bench may be the only access choice where space is extremely limited, but can be problematic. Lifts are the least preferred method because their use focuses attention on the person with disabilities. Lifts also rely on staff assistance to function properly, and are subject to servicing and testing schedules.

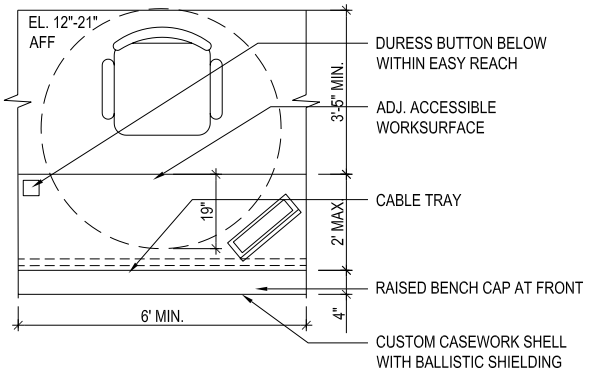


Figure 5.2 Judge's Bench Plan

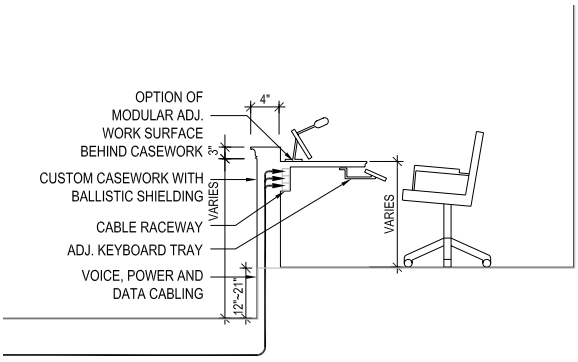


Figure 5.3 Judge's Bench Section

- Courtroom mockups are required prior to finalizing casework construction documents to ensure sightlines and accessibility requirements are satisfied.

5.4 COURTROOM COMPONENTS

The following design criteria shall apply to courtroom components:

Judicial Officer's Bench

The size, location, height, area, and design of the bench reinforce the role of the judicial officer as the administrator of justice, and as the principal controller of order in the courtroom. Design the bench to be the focal point of the courtroom. Bench placement shall not favor any one party. Refer to Figure 5.2 and 5.3.

- Design the bench size and height to be proportionate to the courtroom and ensure an unobstructed view from the entire courtroom. Raise the bench so that the judicial officer's eye level when seated is higher than any standing participant or spectator.
- Include a desktop writing area with a three-inch privacy screen in front. Provide a work surface 72 to 84 inches long by 24 inches deep. This area must be of sufficient size to keep paperwork and reference materials within reach and accommodate computer equipment, such as a video display monitor. Provide adequate bookshelves behind or under the bench. Provide an area for conferences between the judicial officer and counsel at the sidebar. These are typically conducted on the side of the litigation area opposite the jury. Provide built-in or manufactured under-counter storage drawers.
- Provide a minimum of 3'-5" between the edge of the judicial officer's desk and the wall behind. This will accommodate a wheelchair and allow the judicial officer sufficient work area. Design the front and sides of the bench to facilitate transfer of documents and verbal communication between the judge, the courtroom clerk, and court reporter.
- Design the bench utilizing a low custom casework wall, compatible with the courtroom design. Line the wall with ballistic resistant material UL Standard 752, Level III. Provide under-desktop accessible cable raceways to accommodate voice, data, power, and courtroom technology systems.
- Consider providing an ergonomic adjustable desk system behind the casework shell. This component can be made from modular furniture providing adjustable heights and angles of desktop.
- Provide areas for computer equipment, a printer, storage, telephone, and outlets for data transmission. The bench requires a microphone with a mute button, and may include the courtroom audio controls. Refer to Chapter 16 Lighting Design Criteria and Chapter 17 Telecommunications and Audiovisual Design Criteria.

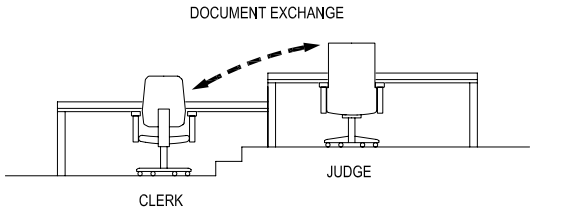


Figure 5.4 Bench and Clerk Elevation

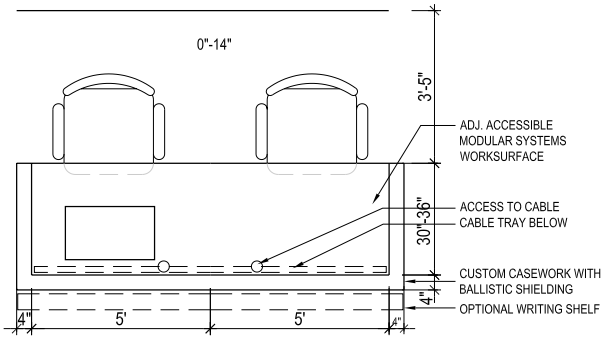


Figure 5.5 Clerk Station Plan

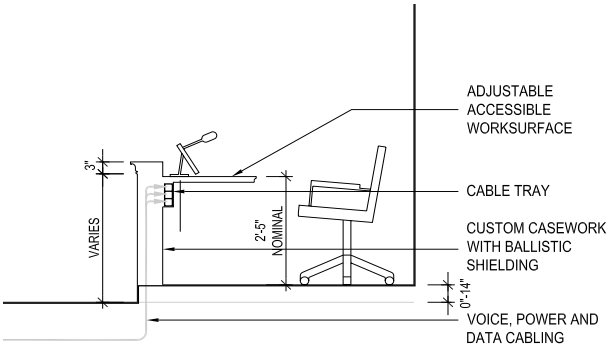


Figure 5.6 Clerk Station Section

Courtroom Clerk's Station

The courtroom clerk's station shall be adjacent to the bench and accessible to counsel for marking and introducing documents. The courtroom clerk is responsible for maintaining a record of case actions and files, and receiving and labeling exhibits. The courtroom clerk must be close to the judicial officer, in order to transfer exhibit papers and files by hand, and communicate privately. The height difference between the clerk's station floor and the judge's bench floor must not exceed 12-inch; the constant transfer of files creates an ergonomic problem if this height difference is exceeded. The clerks' station is located on the same side as the bailiff and near a doorway to the judicial corridor. Refer to Figures 5.5 and 5.6.

- The clerk's workstation requires a 120-inch-long by 30-inch-deep work surface and must accommodate two clerks. An 8 to 12-inch wide optional shelf may surround the workstation to provide a writing surface and add a level of security for documents on the desk. The clerk's workstation requires substantial area for placement of files, forms, supplies, and other material.
- Design the clerk's station similar to the judge's bench, compatible with the courtroom design. Provide a custom casework low front wall with ballistic shielding. Behind the paneling, consider using a modular furniture work surface with adjustable height to provide ergonomic flexibility. Since this work area is used for all office function, such as typing and writing, this work area must meet all ergonomic office work surface requirements.
- Ergonomic accessibility for passing papers between the bench and clerk workstations must be considered in determining the height differential between those two spaces, which is 12-inches maximum. A chute may be used to expedite file exchange between the judge and clerk.
- The clerk's workstation must be cable-ready for in-courtroom computer terminals and requires multiple telephone and electrical outlets, and audio controls. Provide concealed, accessible raceways to incorporate voice, data, power, and courtroom technology.
- The clerk's workstation must be designed with space for a printer and possibly a fax/copier. Provide under-counter file drawers for files and forms, and file storage behind the workstation.

Witness Stand

Locate the witness stand so the witness has a clear facial view of the judicial officer, jury, court reporter, and counsel tables. The witness stand shall be located between the judge and the jury. Refer to Figures 5.7 and 5.8.

- Design the witness stand to comfortably seat the witness and interpreter and accommodate a wheelchair. The witness chair shall be height adjustable and easily removable to accommodate a wheelchair.
- The witness stand must accommodate many people throughout the day. Ramps are the most common solution for access to this area.
- Provide a low wall with a top flat area on which attorneys can rest files or evidence. Provide bullet-resistant material behind the paneling of the

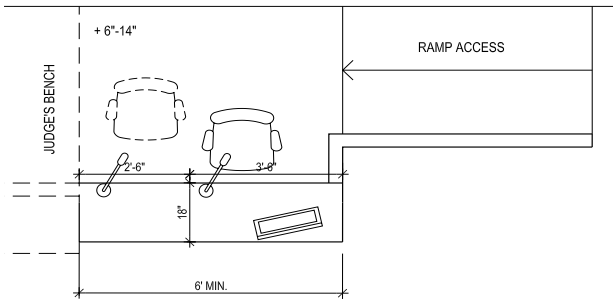


Figure 5.7 Witness Stand Plan

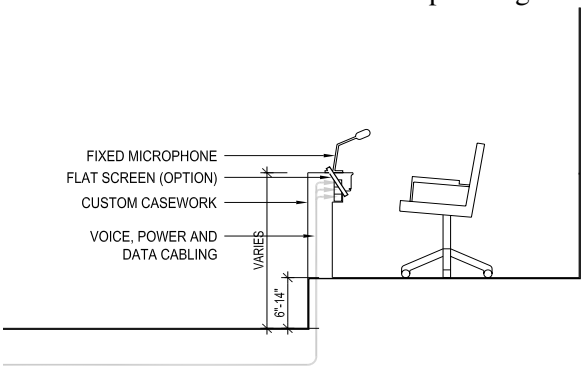


Figure 5.8 Witness Stand Section

Element or Workstation	Furniture/ Casework		Height Above Floor	No. of Occupants	Area S.F.
	Width	Depth			
Judicial Officer	6'-7'	24"-30"	12"-21"	1	64-80
Courtroom Clerk	10'	30"-36"	6"-14"	2	75-85
Bailiff	4'	30"	0	1	25
Court Reporter	4'	30"	0	1	25
Witness Stand	6'		6"-14"	1-2	33-43
Jury Box	N/A	N/A	(1st tier) 0"-7" (2nd tier) 7"-14"	14	144
Counsel Tables	7'-10'	3'-4'	0	2 ea.	90-110
Podium	38"	2'	0	0	

Note: Heights of judge, clerk, witness must be in strict relation – judge highest; clerk within 12" of judge and witness at least 6" lower than judge.

Table 5.2 Court Component Information

witness stand, similar to the judicial officer's bench.

Court Reporter's Area

The court reporter provides verbatim recording of all court proceedings. Locate the court reporter's area so that anything said by participants can be heard by the court reporter. Ensure sight lines to the witness and attorneys.

- Provide a mobile or stationary workstation that includes a work surface at least 24 inches deep, with a lockable drawer for storage, and a modesty panel.
- The workstation shall be cable-ready for in-courtroom electronic recording and computer-assisted transcription. Provide concealed, accessible raceways to incorporate data, power, and courtroom technology.

Jury Box

Provide clear sightlines from each juror to the witness, counsel, judicial officer, and evidence display areas. The jury box cannot extend past either the witness box or the attorneys' tables. Provide direct access into the jury box from the restricted corridor to the deliberation room so the jury does not have to pass in front of the bench or litigant tables. Refer to Figures 5.9 and 5.10.

- The jury box shall be two-tiered, accommodate people with disabilities, and sized to accommodate 14 people. The dimensions shall be approximately 8 feet by 18 feet. The first row of jurors may be at floor level, or raised six inches to seven inches above the floor. Designers shall weigh the advantage of locating the first juror tier at the courtroom floor level, against the disadvantage of attorneys speaking down to the jurors. Additional space

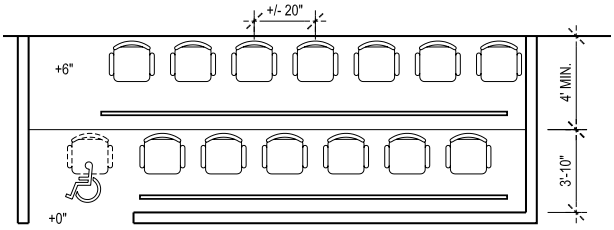


Figure 5.9 Jury Box Plan

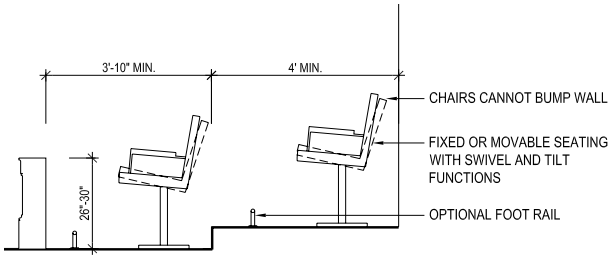


Figure 5.10 Jury Box Section

will be required for wheelchair maneuvering and ramps if the first row is raised above the litigation well floor. When locating accessible seating space, provide sightlines equivalent to other jury seating.

- Design the jury box to prevent communication between jurors and the spectators, and guard against juror harassment. A space of six feet between jurors and the spectator area railing is recommended. Where space is insufficient, provide a physical separation such as a transparent panel between the jury and spectator seating.

- Provide comfortable, ergonomic jury chairs to accommodate people of all sizes. Chairs may be movable or fixed. They must swivel and tilt, and be spaced so that the arms do not collide and the chairs do not strike the rear wall. Provide sufficient aisle space in front of each row of seats for juror legroom. Provide writing surfaces on the jury chairs. Provide a front modesty panel approximately 30 inches high separating the jury box from the litigation area. Handrails and foot may also be provided.

- High-security courtrooms may incorporate additional elements in the jury box, such as glass panels, to secure the safety of the spectators, staff, and court personnel, and ensure secure prisoner movement. Verify these requirements during the programming phase. Prisoners cannot pass in front of the jury box on the way to and from the court floor holding area.

Litigation Area

The litigation area, or well, provides space for primary participants in activities of the judicial proceeding. Size varies depending on courtroom type, and components within well by type of proceeding.

- Counsel tables: Locate counsel tables in the courtroom so that attorneys can be seen and heard by other attorneys, the judicial officer, the witness, and the jury. Provide at least two movable counsel tables with space for comfortable, ergonomic, movable chairs. The counsel tables shall be either custom casework or pre-designed tables to match the courtroom. Tables shall have recessed outlets for voice, data, power, and courtroom technology. All tables shall include a modesty panel to conceal any method of defendant restraint. Provide an area behind the counsel tables and between the spectator area for a row of chairs along the railing for staff, paralegals or other involved parties. This area will be used to accommodate prospective jury members in movable, stackable chairs while a jury is being impaneled. Refer to Figure 5.11 and 5.12 (Counsel Table Plan and Section).

- Lectern: A universally accessible lectern shall be provided for each courtroom. The lectern shall be floor mounted, not tabletop mounted. The lectern shall have recessed outlets for voice, data, power, and courtroom technology and shall plug into a floor box. Provide shelf and space for a digital evidence presentation system (DEPS), VCR, DVD, microphone and attorney laptop.

- Exhibit display area: Provide space for exhibit display and a large ceiling mounted projection screen, located to be clearly visible to all court

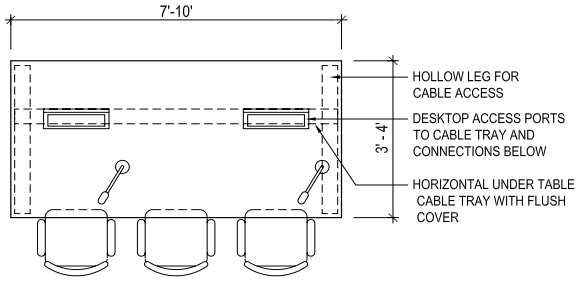


Figure 5.11 Counsel Table

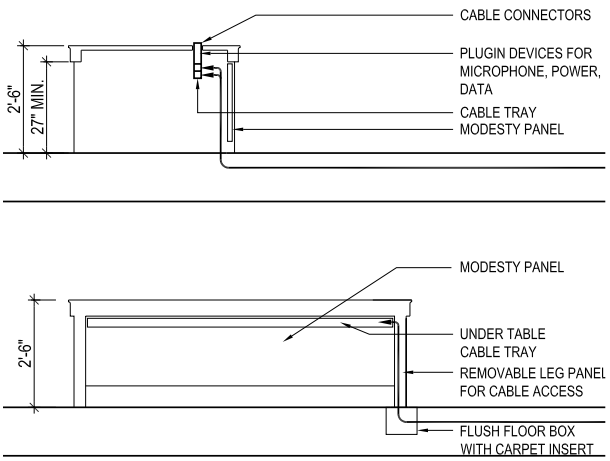


Figure 5.12 Counsel Table Section

participants. An alternative projection screen location is behind the witness, ceiling mounted, if the witness box is provided with a display monitor. Evidence boards shall be provided beside the witness box.

- Exhibit and evidence storage: Provide a secure area for storage of exhibits and for securing any evidence that is at risk of being tampered with or stolen. This area is temporary storage (during recesses in proceeding) and shall be accessible directly from courtroom by the courtroom clerk or bailiff. A pair of courtrooms shares one evidence storage closet.

Bailiff's Station

Locate the bailiff's station within the litigation area to the rear, and in front of the spectator's barrier. In criminal courts, the bailiff is typically located near the door to the in-custody holding area, and requires easy access to the defendant's table.

- Provide the bailiff station with a small work surface, modesty panel and a lockable desk suitable for storage of firearms and ammunition. A telephone equipped with a flashing light rather than a ringer is recommended. An electronic signaling system connecting the bailiff's station and the jury deliberation room is required.
- Incorporate ballistic resistant material into the paneling, and a silent duress alarm system into the workstation design. In large-volume courtrooms, workstations may be provided for two or more bailiffs.

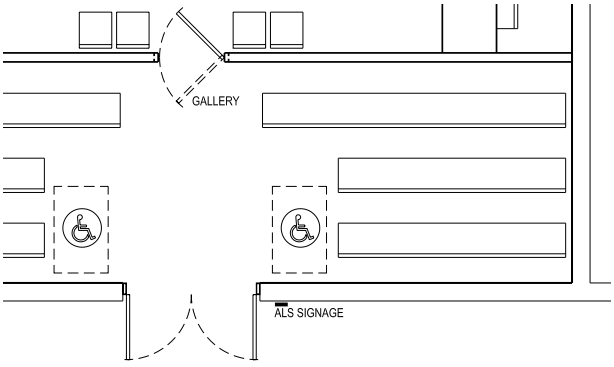


Figure 5.12 Bench Type Spectator Seating

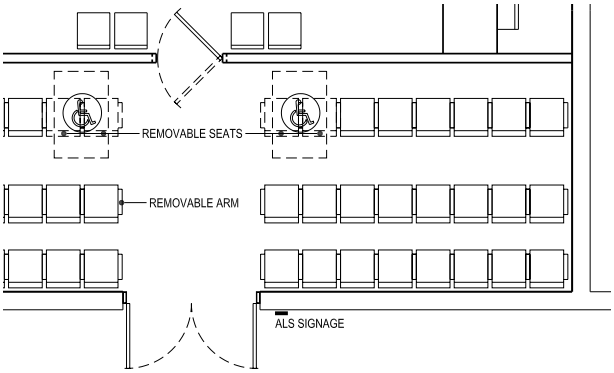


Figure 5.13 Theater Type Spectator Seating

Spectator Area and Litigation Area Separation

The spectator area shall be separated from the litigation area by a relocateable custom millwork separation with swinging gate, 30-33"high, that controls movement and reinforces the hierarchy of the participants. In high-security courtrooms, the two areas may be separated by security glass or a folding glass partition.

Spectator Area

The spectator area provides seating for prospective jury panels, witnesses, and interested parties. The number of seats shall be planned to accommodate voir dire panels for jury selection. Typical panels consist of 75 people; a multipurpose courtroom has seating in the spectator area for the majority of the jury panel; additional movable chairs can be provided inside litigation area and the jury box seating can be utilized during jury selection.

- Bench seating is preferred to individual theater-style seats, because more people and different sizes of people can be accommodated, and bench seating is low maintenance. Benches shall be contoured and proportioned to provide comfortable seating; hardwood veneer and solid wood construction is preferred. Benches shall be anchored to the floor but removable for relocation.

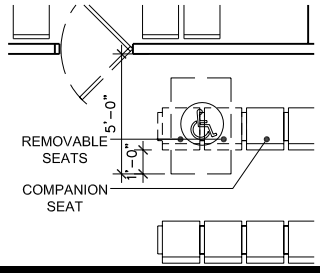


Figure 5.14 Companion Seating Adjacency

Individual theatre-style seating system may be an alternative with specific OCCM approval.

- Provide wheelchair spaces, companion seating, and semi-ambulatory seating. Refer to Figures 5.12 and 5.13.
- In multipurpose courtrooms, accessible seating can be located in one area, generally towards the rear. In large courtrooms, accessible seating areas shall be provided in several locations to equalize sightline advantages. A wide central aisle allows flexibility to persons with disabilities.
- A companion seat must be located adjacent to the wheelchair space. The wheelchair space must be properly aligned with the companion seat. Refer to Figure 5.14.
- Flip up seats are not acceptable in wheelchair locations because companion seat alignment is not possible. Provide space in front and behind the wheelchair space for the wheelchair-bound spectator to roll forwards or backwards to allow other spectators to exit a row. The wheelchair position cannot permanently block exit from an aisle.
- Temporary seating may be placed in wheelchair spaces when not occupied.

5.5 COURTROOM SUPPORT SPACES

Design spaces with flexibility: a jury deliberation suite off the restricted corridor may in the future accommodate staff offices or a settlement conference room.

Chambers

Separate chambers shall be provided for each judicial officer to conduct legal research, case study and review, and meetings with attorneys and other judicial personnel. Since each judicial officer requires a quiet work environment to perform these tasks, distraction-free surroundings are required.

Depending on the number of judicial officers in a facility, consider providing one or more additional chambers for use by judicial officers who are not regularly assigned to the court. Refer to Figure 5.16.

- The chambers shall be designed with a private restroom. Provide adequate sound control between the chambers and staff and reception areas to reduce sound transmission during sensitive conference sessions. Provide natural lighting to the chambers. Refer to Figure 5.15.
- Provide a private restroom in each judicial officer's chambers. If chambers are clustered, a common restroom may be shared among judges

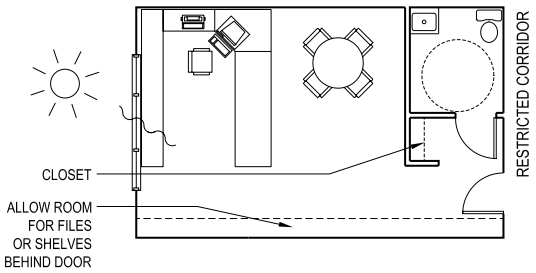


Figure 5.15 Judges' Chamber Plan

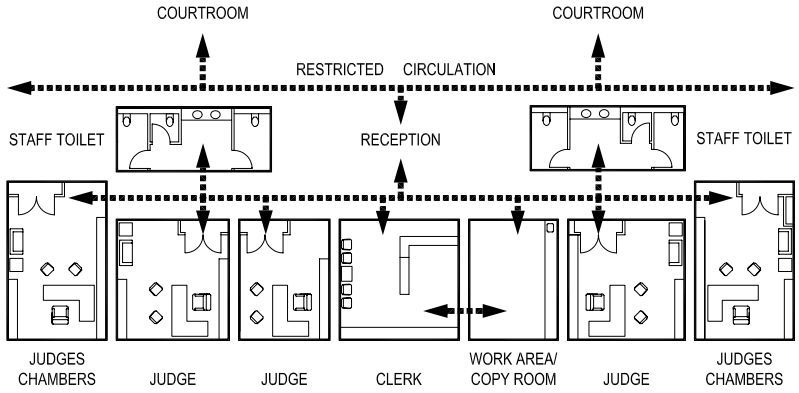


Figure 5.16 Combined Chamber Layout

to lower costs and conserve space.

Support Staff Workstations, Reception, and Waiting Areas

The judicial office may be adjacent to and entered through an anteroom that contains space for one support staff person. This individual performs clerical functions, receives and screens visitors, and maintains legal files for the judicial officer. In some cases this area may function as an unstaffed waiting area. The size of this area depends on related functional requirements.

Copy, Workroom, and Supply Area

Provide a copy, workroom, and supply area, containing photocopy and facsimile machines to be accessible to judicial support staff, research attorneys, attorneys, and bailiffs. A ratio of one copy workroom per every five to eight judicial officers is required.

Court Reporter's Work Area

Court reporters transcribe court proceedings and review transcripts. Provide a separate court reporter's work area; grouping multiple court reporter workstations in a larger area is allowed. Provide an area for locked transcript storage and general office supplies inside or adjacent to the court reporter's work area.

Conference Room and Law Library

Provide a conference room and law library, in the ratio of one room for every five to eight judicial officers. This area shall include bookshelves for reference materials. In small courts, this area may be combined with the jury deliberation function providing no legal books are accessible to jurors.

Research Attorney Offices and Workstations

Space may be provided for research attorneys who review case files and perform legal research for one or more judicial officers.

Jury Deliberation Room

Provide jurors a private deliberation room that is free from distractions and outside interference, accessible from the restricted corridor. Refer to Figure 5.17, 5.18 and 5.19.

- Provide juror deliberation rooms on the ratio of not more than one per two courtrooms, and consider one deliberation room to every three courtrooms. Verify this ratio during programming.
- Design the jury deliberation room to accommodate a table allowing all jurors to participate equally without hierarchy. Round or square tables are preferred to long rectangular tables.
- The jury deliberation room shall comfortably accommodate 14 jurors and allow use of charts, mounted exhibits, and mobile video monitors for evidence.
- Provide one accessible toilet room positioned so that door opens from a vestibule. Provide a vestibule for sound attenuation and to provide reasonable privacy to the toilet room.

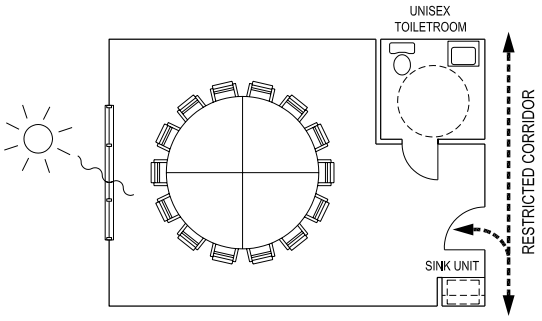


Figure 5.17 Jury Deliberation Room 490 SF

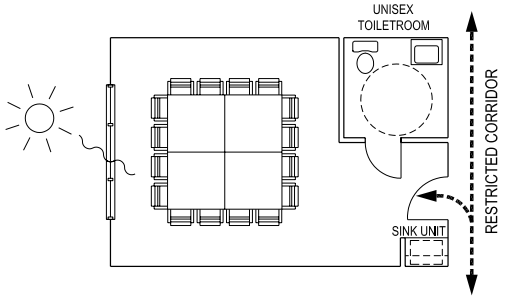


Figure 5.18 Jury Deliberation Room 378 SF

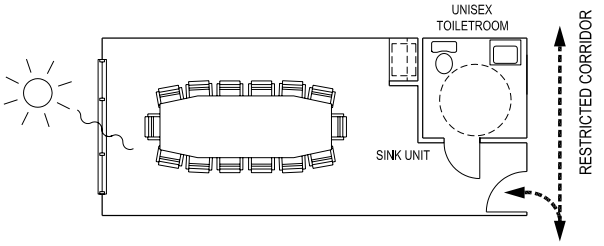


Figure 5.19 Jury Deliberation Room 369 SF

- Provide a sink, water, and counter with cabinet below in the jury deliberation room. Provide space for coat storage. The room shall have natural light; ensure windows do not allow jurors to communicate with those outside the court facility.

Attorney Interview/Witness Waiting Rooms

Provide interview rooms for attorneys and clients, and for conferences with victims and witnesses.

- Provide two attorney interview rooms for every courtroom. In larger court facilities, the number of interview rooms may be reduced.
- Interview rooms shall be accessible from the public corridor but may be reached through the courtroom vestibule if locking configurations allow public access when the courtroom is not occupied.

Law Enforcement Waiting

A waiting room, located off the public corridor near the courtrooms, may be provided in criminal, traffic, and juvenile courts for law enforcement officers to wait prior to court appearances and during court recesses. The waiting room shall be accessible from the public corridor.

Notes:

- Numbered seats indicate accommodation of a 75 person jury panel for voir dire.
- Courtroom as diagrammed is 1,700 S.F.
- Restricted corridor is 6" above courtroom floor.

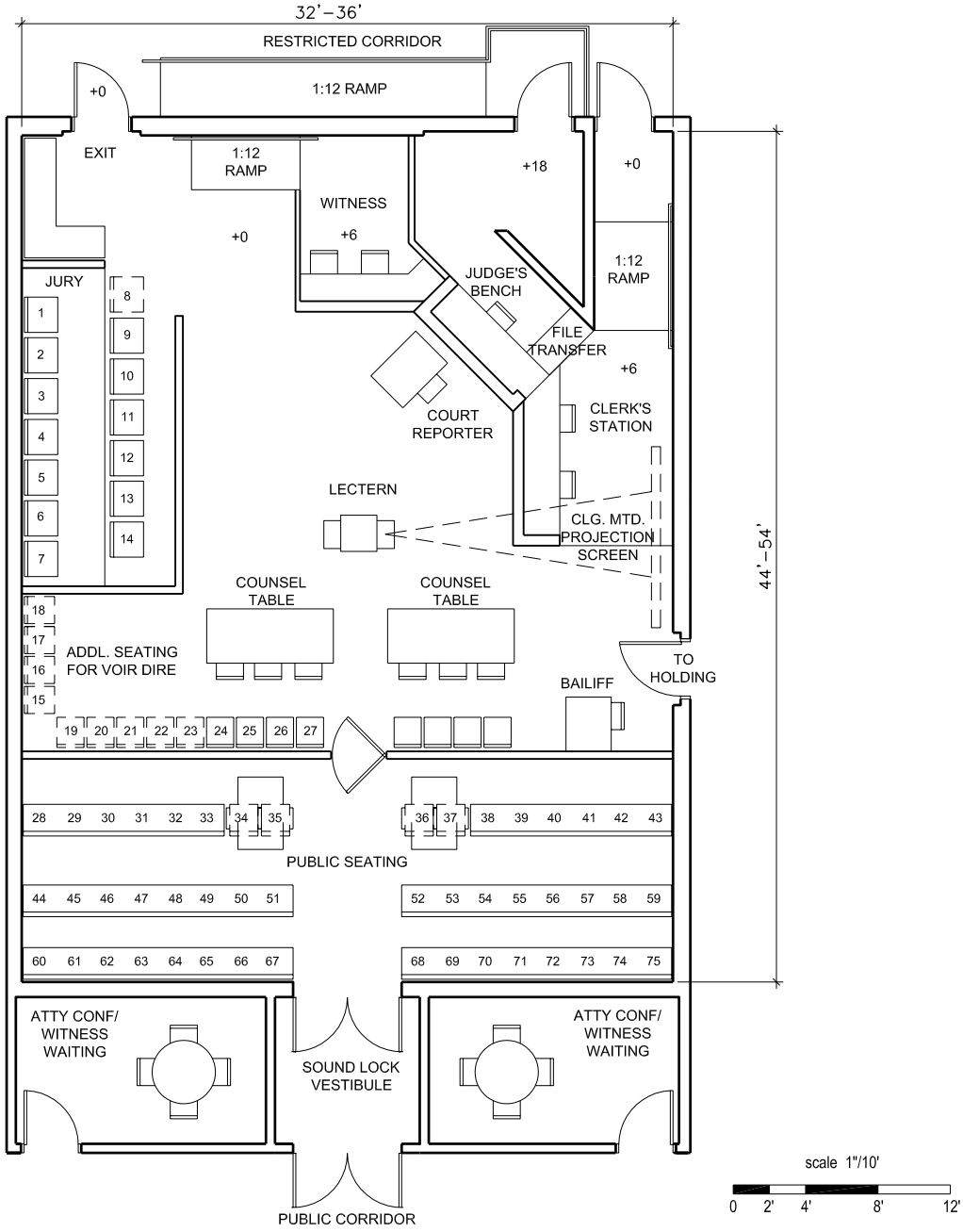


Figure 5.20 Multipurpose Courtroom (Corner bench, seating for jury panel)

Notes:

- Additional seats can be added to accommodate jury panel of 75 (see figure 5.20).
- Courtroom as diagrammed is 1,700 S.F.
- Ramps outside courtroom.
- Restricted corridor at same elevation as courtroom floor.

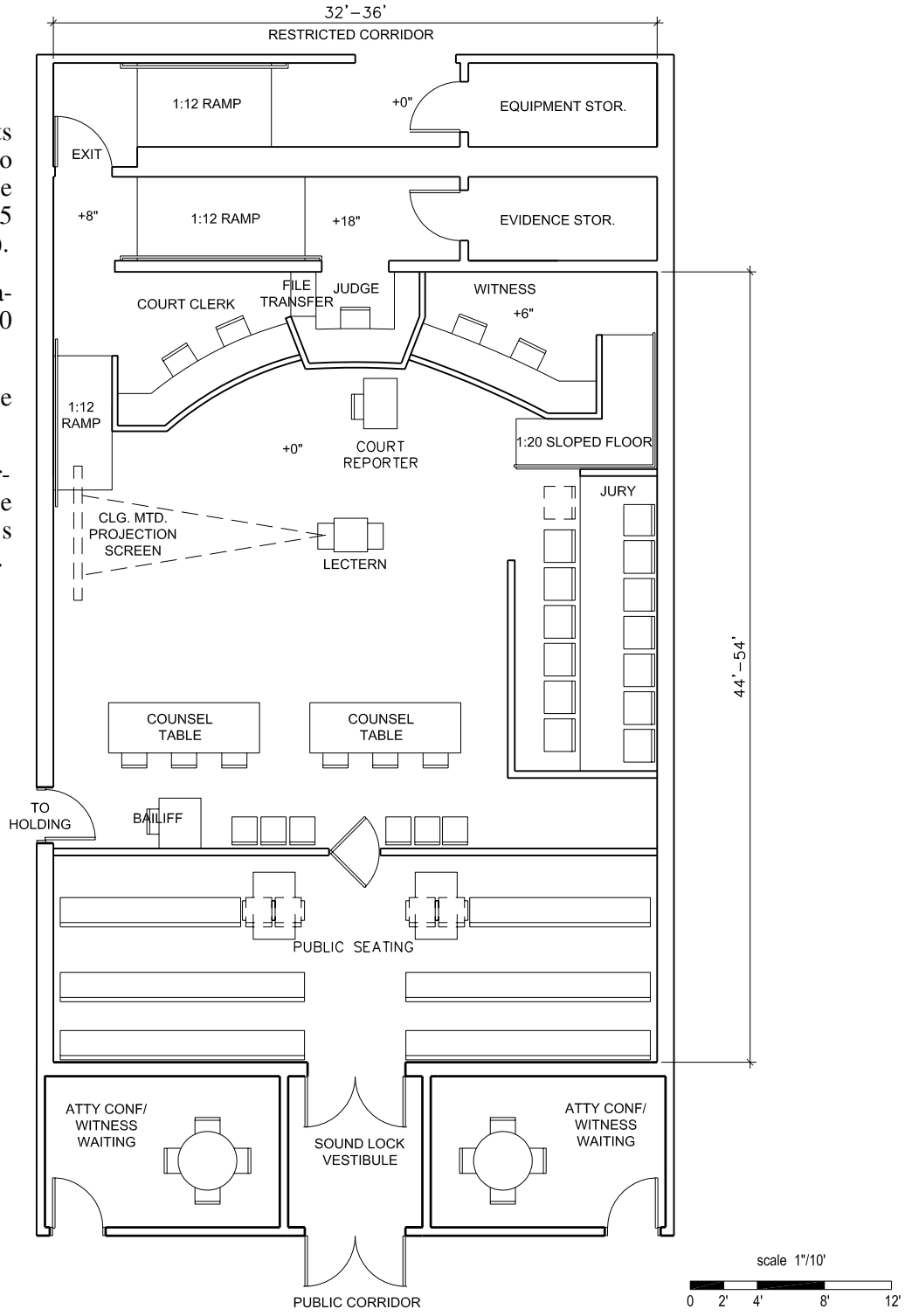


Figure 5.21 Multipurpose Courtroom (Central Bench - symmetrical)

Notes:

- Courtroom as diagrammed is 2,400 S.F.
- Ramp to judge partially outside courtroom.
- Restricted corridor at same elevation as courtroom floor.

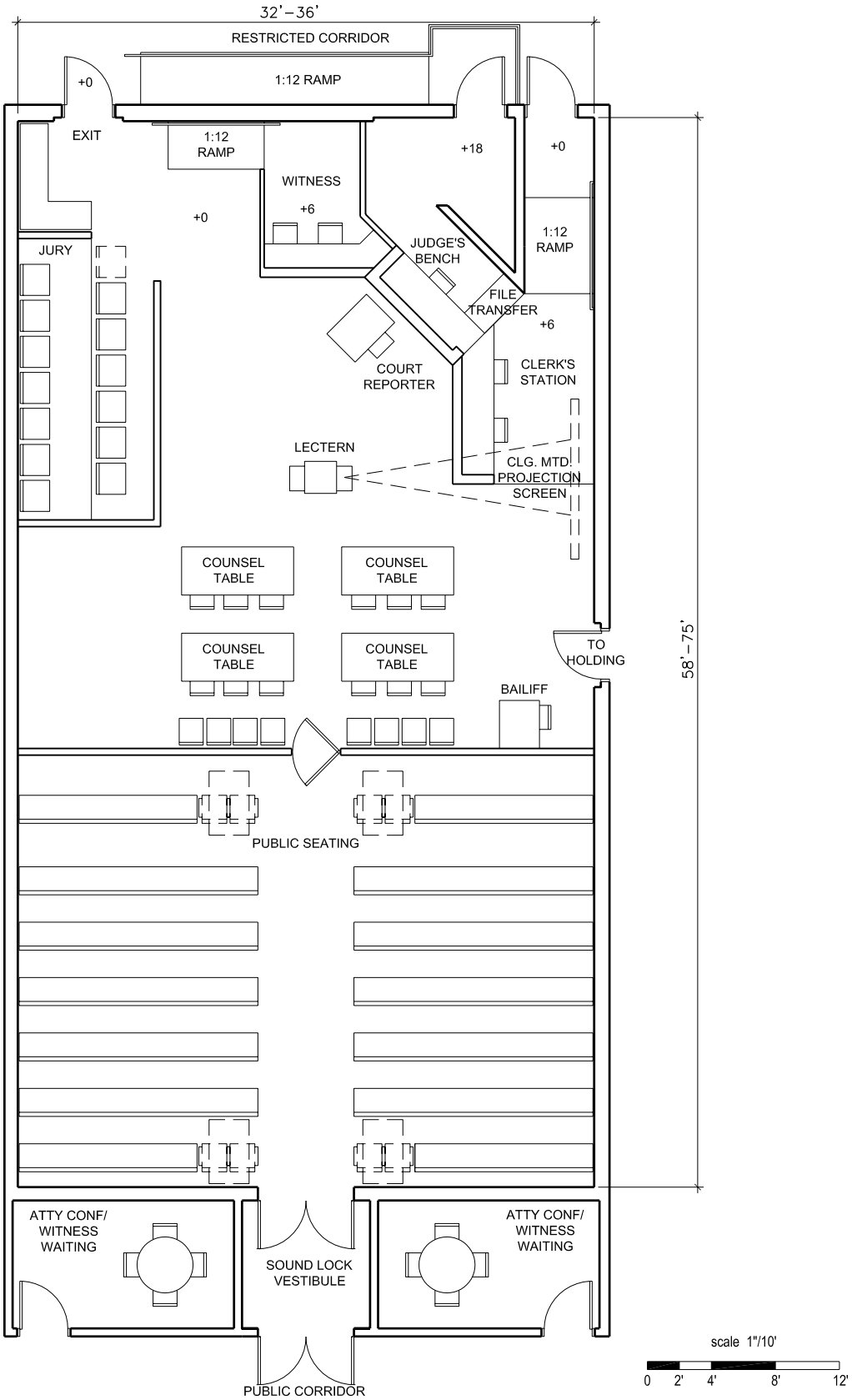


Figure 5.22 Large Courtroom (Corner Bench)

Notes:

- Courtroom as diagrammed is 2,400 S.F.
- Restricted corridor is 6" above courtroom floor.

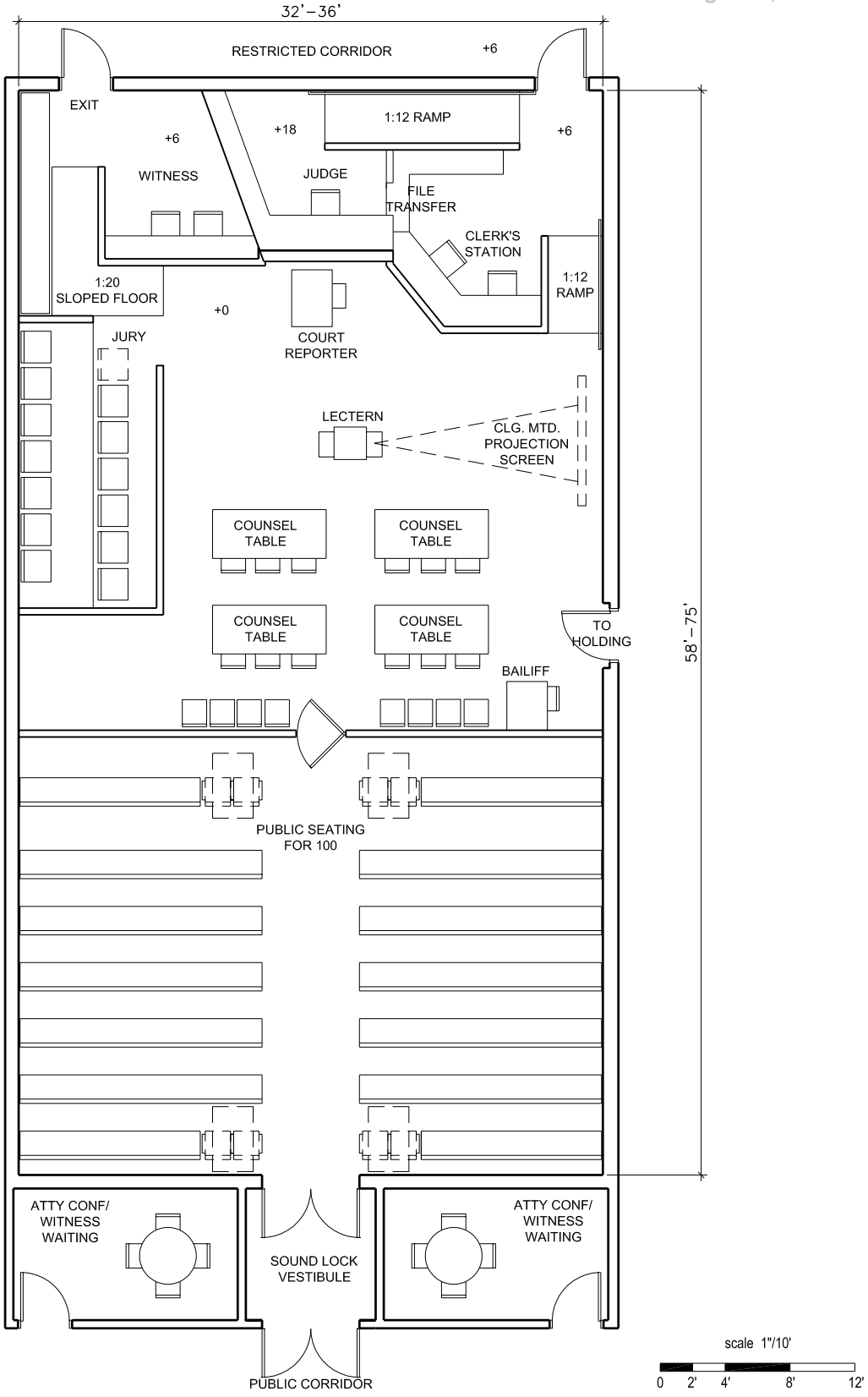


Figure 5.23 Large Courtroom (Central Bench)

Notes:

- Courtroom as diagrammed is 2,400 S.F.
- Restricted corridor at same elevation as courtroom floor.

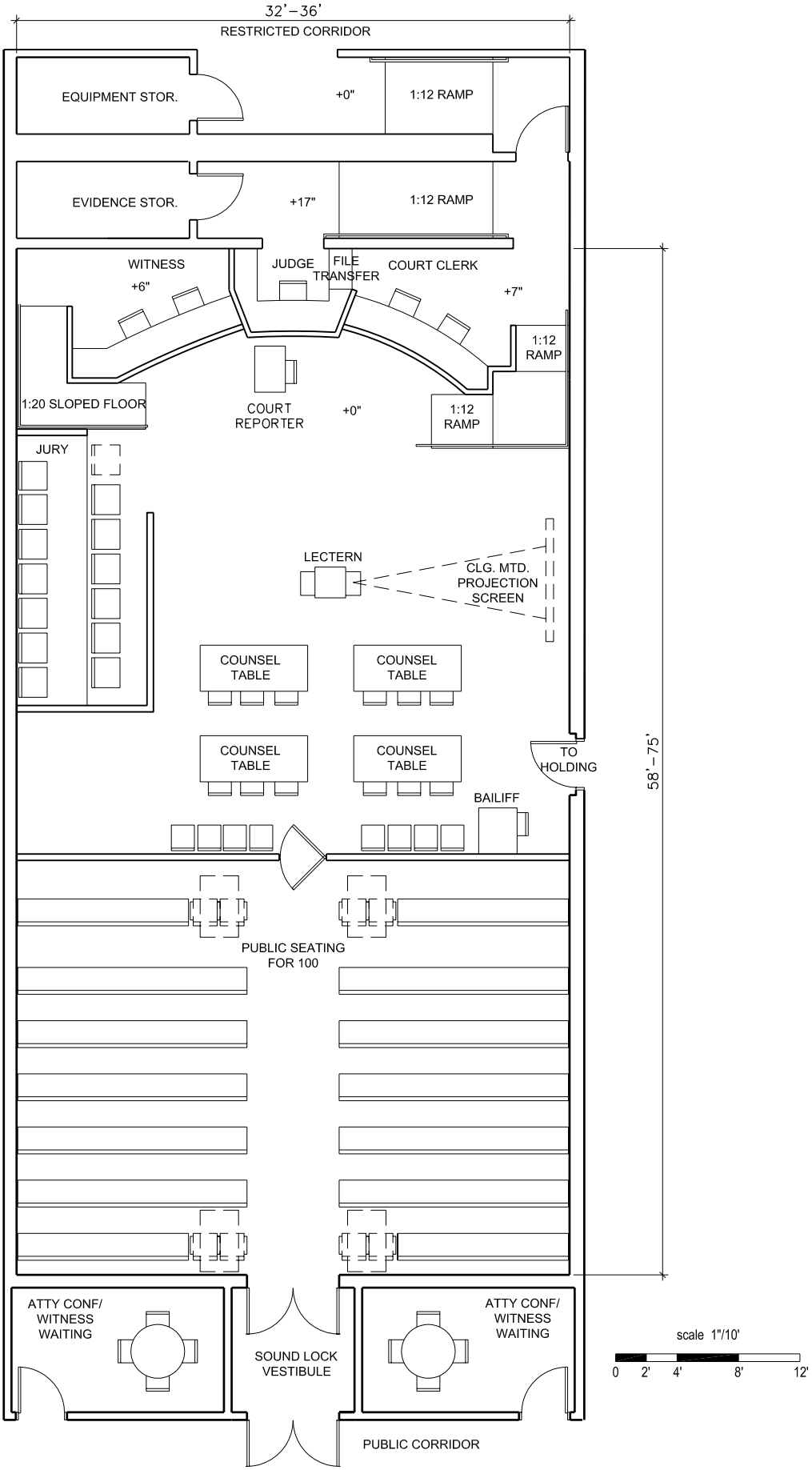


Figure 5.24 Large Courtroom (Central Bench - symmetrical)

Notes:

- Courtroom as diagrammed is 2,323 S.F.
- Restricted corridor is 6" above courtroom floor.
- Ramp to judge is outside courtroom.

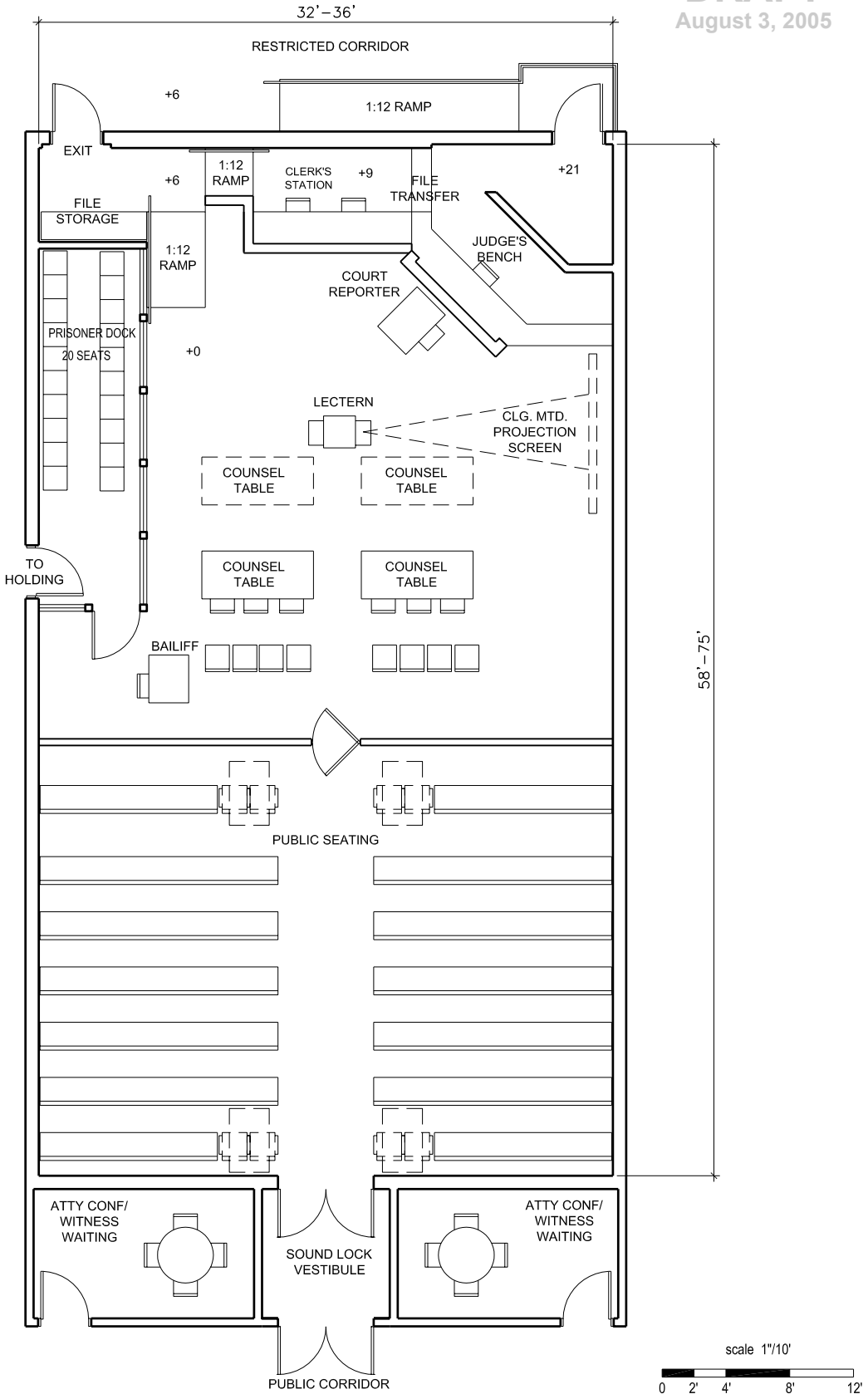


Figure 5.25 Arraignment Courtroom (36' bay, Corner Bench)

Notes:

- Courtroom as diagrammed is 2,325 S.F.
- Restricted corridor is 6" above courtroom floor.

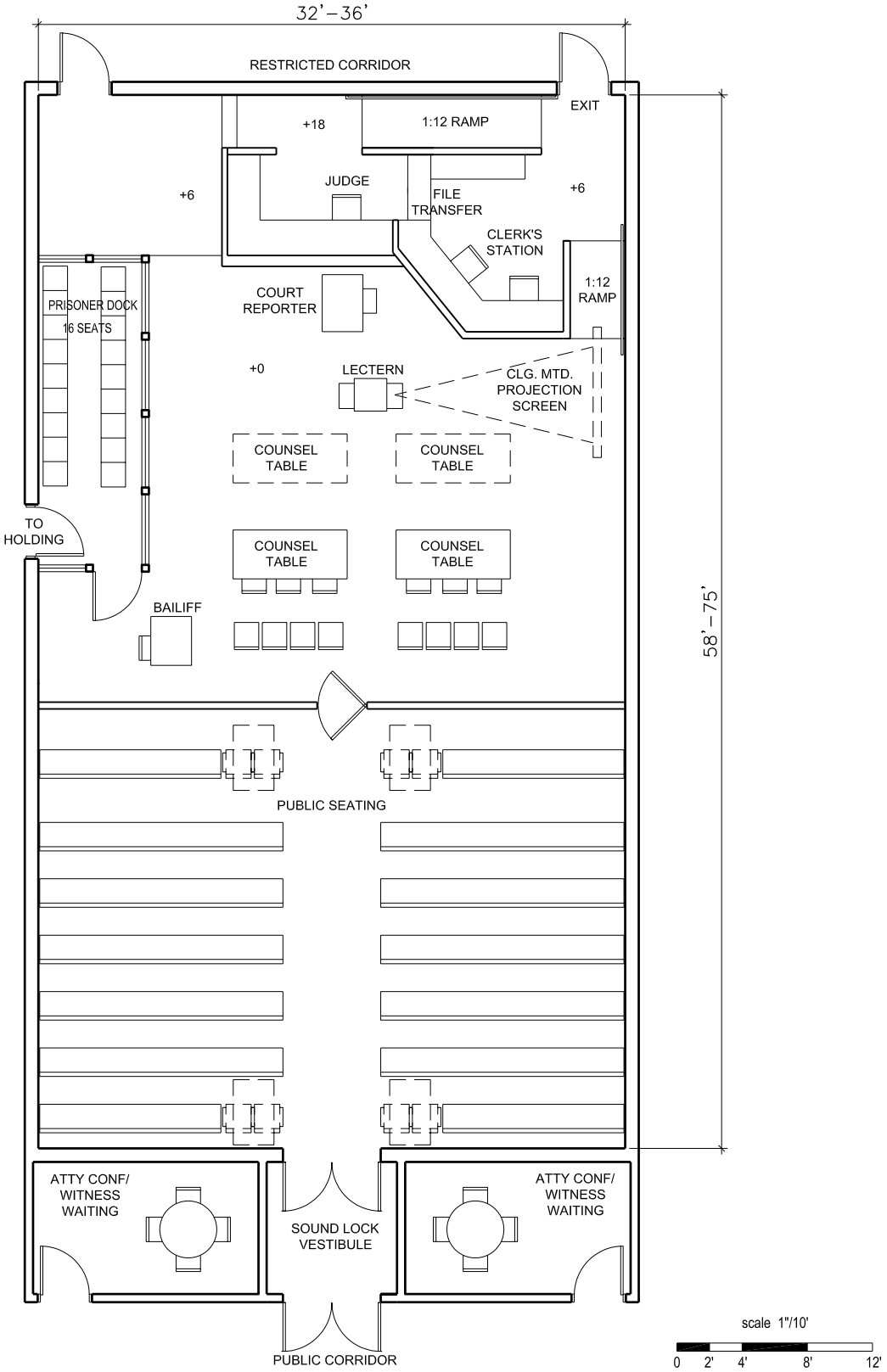


Figure 5.26 Arraignment Courtroom (Central Bench)

6

JURY FACILITIES & COURT ADMINISTRATION

Jury Assembly Room

San Francisco Civic Center Courthouse
San Francisco, CA
RossDrulisCusenbery Architecture
Hood-Miller Associates
Mark Cavagnero Associates/ John M.Y. Lee

6. JURY FACILITIES & COURT ADMINISTRATION

Jury duty is a public service obligation. For many, jury duty is the citizenÓs only contact with the judicial system. The jury assembly area presents potential jurors with a physical symbol of the importance of their duty, and orients them to the process of the courts.

The Trial CourtÓs administrative organization combines the traditional public and case management functions of the Clerk of Court with the financial and administrative services of a modern business. Clerk responsibilities include case filing and tracking, records administration, calendar management, fines, and fees collection, jury services and public information. Business services include staff personnel functions, budget management, information services, statistical reporting, and purchasing. For jury deliberation room standards refer to Section 5.5 (Courtroom Support Spaces).

The number of court staff varies by jurisdiction. Variables influencing court staffing include the number of judicial officers, number and type of case filings, number of court locations, and extent to which business services are provided internally or are contracted with other entities.

6.1 JURY FACILITIES OBJECTIVES

- Plan and design the jury assembly rooms to be comfortable and efficient.
- Locate, size and configure the spaces appropriately to facilitate use by potential jurors.

6.2 JURY ASSEMBLY SPACES

The jury assembly area shall be located on a lower floor near the main court entrance near elevators in a multilevel building. All prospective and selected jurors must enter through the screening station. The entrance to the jury area must be immediately identifiable upon entering the courthouse and easily accessible from public corridors. Jury staff shall be able to control the entry into the jury assembly area.

Ensure traffic to the jury assembly room does not interfere with or impact the security screening process, or block public circulation paths.

The jury assembly area consists of the following components:

Entry Queuing Area

Plan movement of jurors to minimize juror contact with attorneys and litigants. Prominently placed signage shall provide clear directions to the jury assembly area. Jurors arrive simultaneously, so queuing areas will be required for prospective jurors waiting to sign in.

Reception, Check-in, Registration

The reception, check-in, and registration area is immediately visible at the entry of the jury area. This area will vary in size depending on the number of courtrooms and peak volume of anticipated jurors.

Provide medium clerical support workstations.

Jury Assembly Room, Information Presentation Area

- Sufficient seating shall be provided for all prospective jurors. Provide movable ganged seating and lounge seating. The minimum number of seats will vary by the size and location of the facility.
- Provide areas for reading, studying, working, and watching television, designed as acoustically separated rooms or alcoves adjacent to the jury

assembly area. Work areas shall include study carrels with infrastructure for Internet service, if allowed by the court, and power connections for personal computers

- Rooms may serve as multi-purpose community rooms in smaller facilities.
- Provide sufficient restroom facilities adjacent to the jury assembly area. Consider providing additional womenÓs restroom facilities beyond code requirements.
- Provide a podium and infrastructure for wireless or cell phone access.

At the information presentation area, provide for use of audio-video equipment, computer data lines, and telecommunications systems to accommodate programs such as video orientation, automated jury management systems, and juror call-in programs.

Forms Counter

Provide counters for filling out forms. Plan this area to accommodate ten percent of the daily jury call at five square feet per juror.

Coffee and Snack Area

Provide space for three to four vending machines, a table, chairs, and space for water and coffee. Room size shall be proportionate to the number of people served.

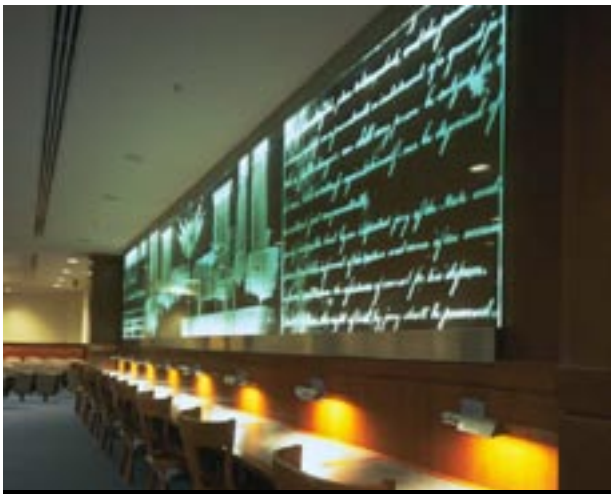


Figure 6.2 Work Carrels in Jury Assembly Room, San Francisco Civic Center Courthouse

Jury Commissioner Office and Jury Staff Area

A small private office may be provided for the Jury Commissioner.

In larger courthouses, space for additional support staff not located in the jury reception area may be required. The size of the support space area will be proportionate to the size of the court facility. The office will be readily accessible to the reception counter. Provide sufficient space for storage of jury records and files.

Mail Center

Provide a work area where staff can prepare juror summons, scan summons return information, and print checks. Most courts outsource printing and mailing, or centralize this function with other mail activities.

Call Center

Provide a work area where staff can answer telephone queries. Larger facilities use call centers or Interactive Voice Response (IVR).

Grand Jury

The grand jury is not a state court function but often shares Superior Court spaces.

6.3 COURT ADMINISTRATION OBJECTIVES

- Co-locate court administrative functions and provide convenient public access to areas with high

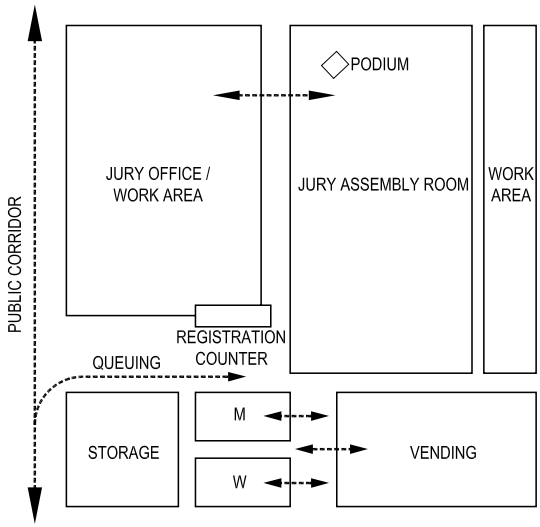


Figure 6.3 Jury Assembly Suite Adjacency Diagram

public contact. These areas should be located on lower floors near the main entry and public elevators in a multistory building. Provide staff areas with easy access to the private circulation system. Connect the court administrative offices to private and public corridors, allowing judicial officers, court personnel, attorneys, and the general public controlled access.

- The appearance of the court administration and case management area shall be consistent with the rest of the courthouse. The public side of the counter area must have high quality, durable finishes. The counters, workstations, and public viewing stations shall use modular furniture to enable complete ergonomic and expansion flexibility. The court clerkÓs office shall be an open-office environment with modular furniture, architectural details, finishes, furniture, wall coverings, paint, and carpet appropriate for administrative offices in a public agency.

- Consider making rooms more flexible by providing telephone, data, and power outlets in areas that may be converted to workstations, offices or conference areas. Electronic case management will affect future record storage areas required, and these areas must remain available for other program needs.

- Provide security to ensure the safety of the public, staff, records, and exhibits. Integrate security duress alarm notification systems into the courthouse security system. Consider security elements in the public service lobby. Incorporate glass and closed circuit TV cameras at the public counter area. In locations not protected by a public entry weapons-screening station, provide bullet-resistant glass barrier systems and counter casework. Provide the evidence storage room and vault with locks and intrusion alarms, located in an area that allows constant supervision. Court clerk staff access shall be restricted by use of key cards or other devices.

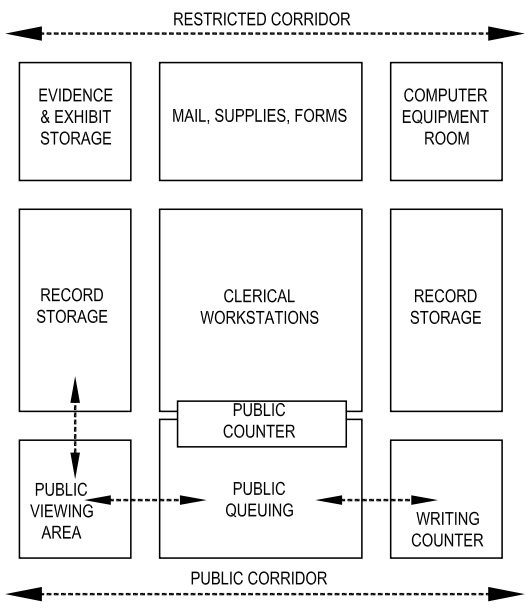


Figure 6.4 Clerk's Adjacency Diagram

6.4 COURT ADMINISTRATION SPACES

The court administration area consists of the following spaces:

Public Counter and Counter Workstation

Design public service counters to encourage access to the judicial system, while providing security for office personnel. Counters allow provide sufficient work area to transact case filing activities, and separate private staff office areas from public areas. Design spaces to ensure efficient and secure acceptance, exchange, review, and reproduction of high volumes of public documents.

Counters must be universally accessible, with the ability to accommodate wheelchair users on each side.

Counter workstation design options include:

- Option 1: Staff workstations shall be designed at an elevation above the public floor that allows for seated, eye-level interaction with customers standing at the counter. Refer to Figure 6.5 (Transaction Height Counter). An accessible writing surface is required on the public side, with depth to equal length of the longest court form. A raised solid barrier between openings screens view of computer and desktop items. The divider height is limited by reach distance. If a raised platform is provided, consider the ability of clerks to obtain records easily.

- Option 2: Staff and public sides shall be accessible at a seated level. Refer to Figure 6.6 (Universal Height Counter). Provide a single height writing surface meeting accessible height and depth re-

quirements. This height will accommodate people standing and those in wheelchairs. Sightlines and sound levels when speaking must be considered in this model. For longer transactions, such as probate, movable seating may be provided for the public; they may stand for short transactions.

Staff assignments to workstations may be permanent, rotating or walk up counters.

- Each permanent counter position will include the counter, staff work space on the private side and standing area on the public side.
- Workstations shall accommodate communication, data processing equipment, and storage space. All counter stations will be configured and provided with power and data to allow cash and credit card transactions. Include outlets for credit card swipe, printer, cash drawer, and cameras. Locations shall facilitate communication and passage of documents between clerks and the public.
- Provide a silent duress alarm at each clerk counter position.
- See Chapter 16 (Lighting Design Criteria) for lighting suggestions.
- Provide permanent counter positions with a means of blocking the view from the public side when the staff member is off duty but still working in the position. Pull down shades or movable screening devices are acceptable.
- Provide security with glass enclosures. This presents a less friendly appearance but is preferred by staff to provide a layer of defense against the public.
- Provide voice transmission through 1¼-inch vertical slots to either side of the window. Provide a pass-through tray. If a glass barrier is not included, the design must include other means for defense, such as a restricted opening width, raised clerk station, and a wider counter.
- Provide a queuing area in the public area outside the counter. Allow 10 feet minimum between the public entrance and the counter for the public queuing area. Provide additional space near the queuing area for a public writing counter for forms preparation.

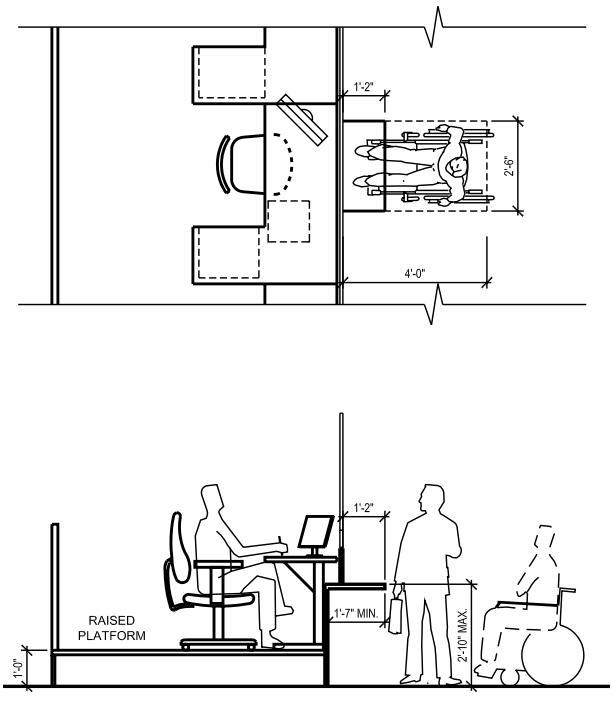


Figure 6.5 Transaction Height Counter

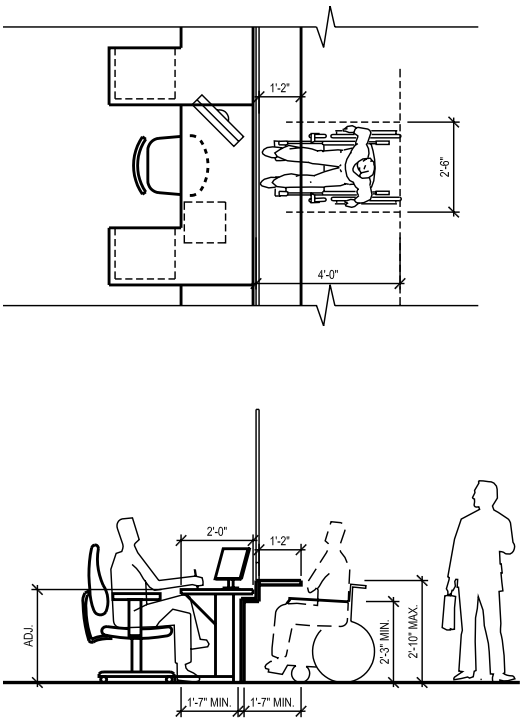


Figure 6.6 Universal Height Counter

- Some public counters may be located on the non-secure side of the security screening station. If counters for fast transactions, such as traffic and attorney filing, are located in the public lobby queuing area or outside, they must be protected with a glass barrier and cameras. Outside counters must be located under an overhang.

- Locate and design drop boxes for convenient public use. Locate drop boxes outside the building at curbside, in a drive-through or within the courthouse public spaces. Review location and design of all drop-boxes, regarding safety and security issues.

Records Viewing

Provide an area adjacent to the public service counter for public viewing of records. This area must be secure and visible to the staff at all times to prevent tampering with or theft of records.

- Provide public computers, copier, facsimile machine, microfilm readers and printers, inquiry terminal and electronic devices designed to make records available for public review and duplication of court documents. Consider providing a turnstile to control passage into and out of this area.

- Provide coin-operated self-service duplication equipment in the public area. Establish a reasonable ratio of public computers to the number of counter stations.

Court Executive OfficerÓs Suite

Office needs for the Court Executive OfficerÓs suite include an office for the Court Executive Officer (CEO), a reception area seating two; offices for assistant court executives; a conference room adjacent to the CEO office; workstations for staff; and 40 to 60 NSF per staff member for files and office equipment. A separate restroom for the CEO is not required. This suite can be separate from the main clerkÓs office, but shall be located in the restricted area.

Offices and Workstations

Workstations and office furniture shall be modular furniture to enable complete ergonomic and expansion flexibility. Provide medium workstations overhead storage. Low partitions, at 42-inch height, are encouraged for part of the enclosure to promote communication and visibility to the public counter area. Some stations can be combined into a shared work area and shared central small conference area.

See workstation size standards in Table 2.2 (Space Standards), and planning criteria below for office area requirements. Provide space for:

- Office equipment, files, storage, counters, and special work areas

- Visitors, meetings, training, reception, and waiting areas

- Dedicated conference and meeting rooms, unless staff can share other meeting spaces.

Case Management and Assignment

Workstations in the case management division will from small to large depending on the staff position. This area includes counter workstation positions to assist attorneys, court clerks, and the public. Provide 40 to 60 NSF per staff member to accommodate files and office equipment.

Information Systems

Information systems include systems development, programming, information management, technical support, planning, and research operations. These functions are primarily nonpublic and require office and workstation environments. Larger jurisdictions maintain technical libraries, computer server equipment rooms, computer workrooms and, occasionally, large mainframe computer operations.

Purchasing

Office space needs for purchasing staff include small to large workstations for buyers or other support staff, and a medium office for management. Consider a small conference space for meetings or negotiations with vendors.

Revenue and Collections

The revenue and collections office area requires small to large workstations. Provide a public reception area and counter space for information and payment transactions.

- Provide counter workstation positions, and 40 to 60 NSF per staff member for files and office equipment.

- Provide space for multiple file cabinets for records

and files and a small conference space within or adjacent to the revenue and collections functions.

- Provide acoustical separation of any public space and staff areas where confidential telephone and personal conversations occur.
- Consider providing separate storage with restricted access and security camera for a safe.

Human Resources

The human resources office area requires large workstations. Provide space for multiple file cabinets for records and files and a small conference space within or adjacent to the workstations. Provide duress buttons at public counters and any staff work area used for employee termination.

Records Storage

Provide space for microfilming and scanning documents for storage, and to accommodate future records storage and retrieval technologies.

Floors must be designed to accommodate file weight. Provide minimum aisle widths of 36 inches. Consider providing non-liquid fire suppression protection of file storage areas. See Chapter 16 (Lighting Design Criteria) for lighting suggestions.

Some jurisdictions distinguish between active and inactive records for file storage purposes. Active records include open or regularly accessed files that are generally stored adjacent to the court clerk work areas. Active records are often maintained in indexed, open shelving units for easy access. Inactive records are often stored at a more remote location. Assume 70% of records will be active. Typically three to four years of records are maintained onsite. Records must be maintained, pulled upon request, routed, and interfiled. A microfilm and destruction program, if available, can help control growth of records storage.

Active Records Storage

Provide sufficient space for active file storage. Active records must be easily accessible from the court clerk work areas and in a secure location.. Functional requirements and policies of each courthouse will influence the location of the active file storage area; locate on the ground floor because of structural loading issues.

- Adequate workspace must be included adjacent to the file storage equipment.
- High density record storage is preferred for most active file storage because of the smaller footprint, but cannot be used in departments requiring constant file retrieval. Manual systems are preferred over electric because of maintenance and failure rates. Design with some fixed aisles so several aisles can stay open for staff access. A locking feature may be used to secure confidential files. Specify record storage seven shelves high.
- Optical disk processing substantially reduces file storage space while increasing file input and viewing capabilities.

Inactive Records Storage

If inactive files are stored on-site, an adequate and accessible storage area must be provided. Spatial requirements will vary in accordance with the number of records and the length of file retention schedules.

- Warehouse shelving is recommended.
- The inactive record storage area must not fluctuate in temperature or humidity. Protect the file storage medium, whether paper, microfilm, or optical disk, against deterioration or damage from flooding or moisture.

Training and Conference Rooms

Provide a training room for court staff. Locate this space for easy accessibility by staff. Design for flexibility with multipurpose furniture and a projection screen to accommodate training, conferences, and other meetings. See Chapter 16 (Lighting Design Criteria) for lighting requirements, and Chapter 17 (Telecommunications and Audiovisual Design Criteria), for audiovisual requirements. Provide small conference rooms adjacent to workstation areas.

Mail Center

Provide an area for intake, sorting, and mail distribution. Large facilities may require additional area for mechanical and electrical components to support HVAC bio-filtration systems.

Other Support Areas

Other support areas may include copy facilities, sup-

ply rooms, restrooms, and break areas.

- Provide copy areas to accommodate high-volume copying. They must be ventilated to dissipate copier heat and fumes, and located to minimize noise disruption of other work areas. Depending on the size of the court facility and workload, convenience copiers may be located throughout the building.
- Provide an area with adequate shelving and work areas for storing office supplies.
- Allocate space for employee restrooms. Consider current and projected future staff composition when determining the number of toilet fixtures. Additional restroom facilities for female employees may be required.
- Provide a staff break room with a sink, disposal, and casework. Employees shall provide appliances.
- Provide a lactation room for employees.

Equipment Storage

Provide a locked area for equipment storage including computer equipment.

IS Workroom And Storage Room

Provide space with a 32-inch counter on two sides. Provide a 14-inch shelf 21 inches above the counter. This casework shall be plastic laminate finish. Above the counters, provide a continuous plugmold electrical unit.

7

SPECIAL SERVICES

Exterior
Peter L. Spinetta Family Law Center
Martinez, CA
RossDrulisCusenbery Architects

7. SPECIAL SERVICES

Family Law Facilitators, Self Help Centers, Family Court Services, Juvenile Dependency Mediation, Child Waiting, and Alternate Dispute Resolution (ADR) programs increase the efficiency of certain types of court cases. The litigant has better information, issues are settled more frequently, court appearances are minimized, and using these services reduces paperwork.

7.1 OBJECTIVES

- The following group of spaces must be convenient to the public and must be located off the public corridor or public waiting. These areas, must also have access to private circulation systems.
- Many Family Court Services and Alternative Dispute Resolution services are conducted after regular court hours; access to these offices and restroom facilities during non-court hours must be available without compromising the security of the remainder of the courthouse.

7.2 FAMILY LAW FACILITATORS AND SERVICES FOR SELF-REPRESENTED LITIGANTS

Family Law Facilitators

Family Law Facilitator programs are a mandated service. Supervised by experienced family law attorneys, they provide self-help assistance to litigants with child support issues.

The following description indicates the role of the facilitators in the litigation process.

> *Family Law facilitators guide litigants through the forms and procedures related to child support, spousal support, and maintenance of health insurance. They assist with cases involving the local child support agency, many of which are cases requiring reimbursement for public assistance. Many facilitators are involved in community outreach programs. Facilitators provide mediation*

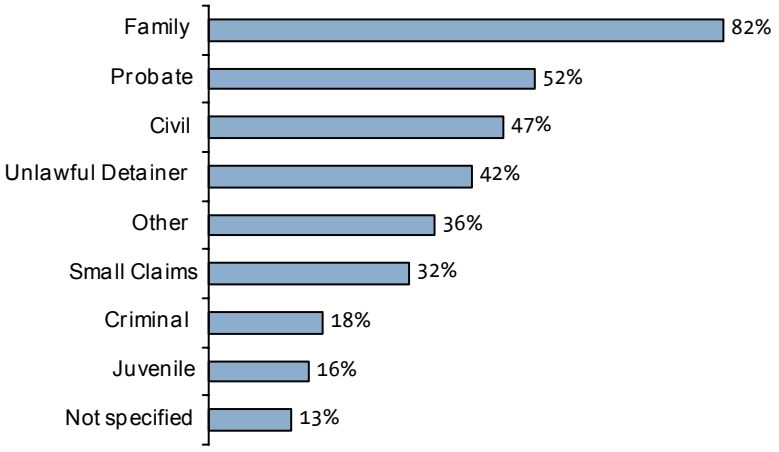


Figure 7.1 Self-Represented Litigant's Needs (by Case Type) (From *Highlights from the report of the Task Force on Self-Represented Litigants*)

services, in which they meet with both parents and help work out child support issues. Some courts have enlisted volunteer attorneys or provided additional funding that enables facilitator to assist self-represented litigants in other family law areas, including divorce, custody and visitation.

Task Force on Self-Represented Litigants, highlights from report

Most courts have expanded their family law facilitator's activities to provide other self-help assistance in family law and a growing number of courts provide self-help in other areas. In the *Statewide Action Plan for Serving Self-Represented Litigants*, approved by the Judicial Council in 2004, attorney-supervised, staffed self-help centers are recommended for every court.

Family Law Facilitators and Self Help centers provide assistance and practical information about court procedures for pro per litigants (representing themselves in litigation) visiting or using the court. Locate self-help centers near the Clerks' Offices, off a public corridor.

Reception, Waiting and Triage Areas

- Provide public waiting for users and children, with child waiting, reception counter, and triage area. The volume for these services is extremely high. In large courts, seating should be available for forty to fifty people.
- Furnishing and equipment needs include: small tables for filling out forms or conferencing that can be reconfigured for classes, computer terminals, located against the wall; brochure racks, shelving, storage, video monitors, and a coin-operated photo copier.
- Provide staff workspace with file storage, work counters, and equipment. Public counters and reception areas may be integrated into the work areas.

Figure 7.1 Self Help Center, San Francisco

Workshop Rooms

In jurisdictions with more than one family law facilitator, provide a workshop room. The room must accommodate reference materials, audiovisual equipment for workshops and computers to allow litigants to complete typewritten forms. See Chapter 16 (Lighting Design Criteria) and Chapter 17 (Telecommunications and Audiovisual Design Criteria) for technical requirements.

- In jurisdictions with at least one full time facilitator, provide two small conference rooms for services to be provided by volunteer attorneys, paralegal and other staff supervised by the attorney Facilitator/Self Help Center Attorney's office
- Provide one private office per facilitator and staff attorney. The office shall accommodate up to five people to allow for mediation.
- Provide a duress alarm in offices and counter.

Small Courthouse Model

Provide one room designed so one staff member can provide supervision and control.

Impact On Courtroom

Provide brochure rack and video outside the Pro Per courtroom to instruct users on courtroom procedures.

7.3 FAMILY COURT SERVICES

Courts are required to set contested child custody and visitation issues for mediation. Family Court Services (FCS) provide mediation, which must include mandatory orientation as well as a mandatory intake process that screens for, and informs staff about, any restraining orders, dependency petitions under Welfare and Institutions Code § 300, and other safety-related issues affecting any party or child named in the proceedings. California Rule of Court, Rule 5.215 requires FCS to conduct differential domestic vio-

lence assessments, make reasonable efforts to ensure the safety of victims, children, and other parties when they are participating in services provided by Family Court Services; and, consistent with Family Code § 3113 and 3181, offer separate mediation sessions at separate times when there is a history of domestic violence, or when a protective order as defined in Family Code § 6218 is in effect, or if domestic violence is discovered while mediation or evaluation services are in process. A domestic violence support person may accompany a party protected by a restraining order to mediation and orientation. In child custody and visitation cases, FCS may also offer appropriate services as available, such as child custody evaluation, parent education, relevant education programs for children, booklets, videotapes, or referrals to community resources. FCS offices also commonly offer such services as stepparent adoption, conservatorship and guardianship investigations.

The Family Court Services (FCS) mediation area can generate considerable traffic flow. Locate FCS on a lower floor close to the main lobby, or near elevators on an upper floor. Other civil mediation and arbitration services do not generate the same traffic load as FCS and may be located away from the main lobby. Parties using FCS often also use Family Law Facilitator/Self Help Services; so locating these services nearby would be helpful to the public. If possible provide more than one exit from FCS, to provide alternate access for domestic violence victims who are participating in mediation.

The Family Court Services consists of the following areas; for sizes refer to Table 2.2 (Space Standards):

- Public counter and workstation space
- Mediator and evaluator offices
- Reception and waiting areas
- Orientation room
- Mediation room
- Conference and training room
- Children's waiting area
- Security station
- Equipment storage

Mediator's Office

Provide a private office for each mediator. The office shall accommodate up to six people.

- Provide acoustical treatment of office walls and doors.
- Provide a duress alarm, due to the potential for physical confrontation.

Reception and Waiting Areas

Provide reception and waiting areas with seating sized for the court's needs.

- In large jurisdictions, provide a reception counter and sign-in area, with a counter position.
- Provide duress alarms in support staff work.
- Provide an area for copy and fax machines adjacent to clerical staff and mediators.
- Provide space for FCS files and records adjacent to clerical staff.
- Reception area shall provide sufficient space to accommodate mandatory screening, intake, and differential assessment. Private space should be available to safely consult with vulnerable parties, such as victims of violence.
- If possible provide separate waiting areas for different parties in mediation. One or two reception and waiting areas will serve several mediation offices. Separate FCS waiting areas should be available for domestic violence victims, so that they do not have to be in the same area as the alleged perpetrators.

Orientation Room

Figure 7.2 Child Waiting Room, San Francisco

Provide an orientation room with seating for four to six people, to conduct orientation sessions prior to participation in mediation or other alternate dispute resolution services.

In large facilities provide larger areas, with a television monitor for video orientation at one session, and seating for 30 people.

Mediation Room

Provide a mediation room. In some jurisdictions, a combination of large and small mediation rooms will accommodate large family groups and allow involvement of social workers, and other staff.

- Provide acoustical treatment of office walls and doors, due to the confidential and sometimes vocal exchanges associated with these discussions.
- Provide an inconspicuous duress alarm, due to the potential for physical confrontation.
- Provide video cameras to allow remote observation of proceedings.

Conference and Training Room

In jurisdictions with more than eight FCS mediators, provide a conference and training room of 200 NSF, and increase size proportionate to the number of mediators. The room must accommodate reference books and related materials needed by mediators to conduct their business. See Chapter 17, Lighting, and Chapter 18, Court Technology, for audiovisual requirements.

- One room may be used for mediation, orientation, conference, and training.
- Room also may be used for case conferencing and staff meetings.
- Provide access to the public corridor to allow non-courts users to use the space for multi-disciplinary training without incurring security risks.

Children's Waiting Area

If no other children's waiting area is available or convenient, provide a separate children's waiting area near FCS when children or their parents or guardians are involved in court proceedings.

Security Station

Security provisions for the FCS area vary based on the size and location of the function. If remote from the court security staff, the FCS area may require a separate security post. If security staff is stationed at FCS, provide a post with workstation and security equipment. If the FCS area is not within the secure perimeter, a separate security screening station may be required.

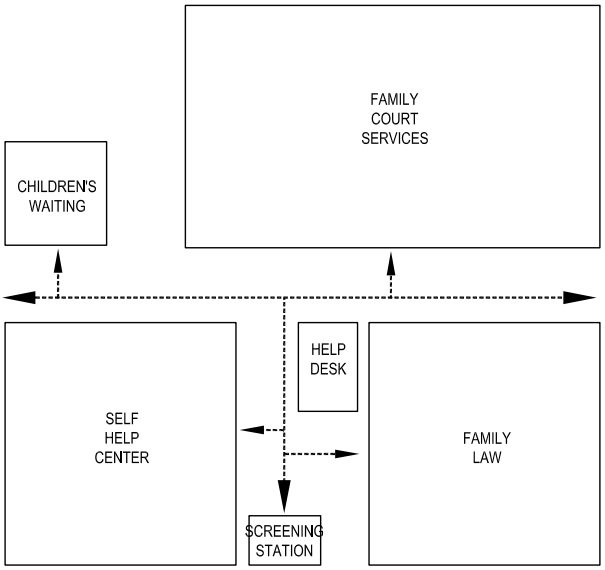


Figure 7.3 Special Services Adjacency Diagram

Equipment Storage

Provide an area near the mediation rooms for storage of equipment and furnishings, such as video monitors, used in mediation.

7.4 CHILD WAITING

Standards of Judicial Administration Recommended by the Judicial Council require provision a safe place for children to play while their parents conduct their court business. Provide a child waiting room in all court facilities. These spaces are required under the Rules of Court listed below:

> *Each court should endeavor to provide a children's waiting room located in the courthouse for the use of minors under the age of 16 who are present on court premises as participants or who accompany persons who are participants in court proceedings. The waiting room should be supervised and open during normal court hours. If a court does not have sufficient space in the courthouse for a children's waiting room, the court should create the necessary space when court facilities are reorganized or remodeled or when new facilities are constructed.*
>
> *California Rules of Court Sec. 1.3. Children's waiting room*

- Provide an area of 120 NSF for two to three children, increasing in area by 15 NSF per child. The waiting area must be located near the security station but in a semi-private corridor. Space needs will vary with court caseloads. Consider providing separate areas for adolescents.
- Provide a check-in workstation with a duress alarm, and view of entire room, to allow supervision by one staff person; design facilitates safe check-in and check-out of children. Provide file storage for administrative records, forms and brochures.
- Do not allow outside visual access or windows; the public shall not be able to look into the room. The children must be in a controlled situation. Access doors shall be locked with a remote buzzer operated from the check-in workstation.
- Provide one or two restrooms, one with child size fixtures and a changing table.
- Provide a second door into secure corridor. Small facilities can use a multipurpose room.
- Provide space for child-sized tables, chairs, sofa, and floor games.
- Provide storage space for toys and games.
- Provide space for information racks about community resources for service referrals and community resources (housing, health care, child care, literacy and education).
- Provide a quiet room with glass walls, sink and locking cupboards, refrigerator, and microwave.

7.5 ALTERNATIVE DISPUTE RESOLUTION

Alternative Dispute Resolution (ADR) services are an increasingly important part of the judicial process. In the civil case context, ADR includes the traditional civil case settlement process involving a judicial officer, attorneys and the litigants; mediation, involving a facilitator and the parties, sometimes without attorneys; and arbitration, involving an arbitrator, attorneys, and the litigants.

In family court, ADR commonly takes the form of court-mandated mediation provided by Family Court Services (FCS) involving a mediator, family members, including children, and occasionally others, such as social workers. Family Court Services mediation generally occurs in court facilities.

Civil case mediation and arbitration services may be provided privately and occur outside the court facility. Civil case settlement conferences often take place in a courtroom or conference area. As the concept of the multi-door courthouse develops, in which all judicial services are combined at one location, court-sponsored mediation and arbitration services may increasingly be provided in the court facility.

Provide space for civil case settlement conferences and mediation and arbitration services within the court facility. Requirements for these functions may vary considerably depending on anticipated volume of usage. In larger jurisdictions with formal ADR programs, consider multiple rooms of various sizes and capacities. For sizes refer to Table 2.2 (Space Standards). If provided, space for these functions may include:

Mediation and Arbitration Rooms

Provide one or more conference for mediation, arbitration, and settlement conferences to accommodate

a minimum of six participants. Each room must accommodate a mediator, parties and attorneys. Provide a caucus room.

Mediation and Arbitration Coordinator's Office

Provide a workstation for the individual responsible for scheduling and coordinating attorneys and clients.

Reception and Waiting

Provide an area with seating for six to eight people, where attorneys and litigants can be seated while waiting for a mediation room. This area can serve one to four mediation rooms and may be increased in size according to the number of additional mediation rooms required.

7.6 MULTIPURPOSE ROOMS AND OFFICES

Provide several multipurpose rooms, to be assigned at the court's discretion, so that attorney conference areas do not get utilized for the purposes below. The quantity of rooms shall be determined during programming. Provide keypad locking so Courts can change the use easily. Locate rooms off of the public corridor for Courts for a variety of uses including:

- On-Site Drug Testing Room: provide a room used for drug testing adjacent to the courtroom
- Attorney Convenience Center: Provide a work and waiting area, with power and data communications for laptop connections, for attorneys' use while at the courthouse. This area allows attorneys to prepare and read court papers, make telephone calls and conduct other court-related activities.
- Multi-agency and Volunteers Convenience Center: Provide workstations for volunteers. In larger counties with comprehensive or centralized volunteer programs, provide a coordinator's office. Locate on a semi-private corridor.
- Law enforcement and waiting: Law enforcement waiting areas must be located off public corridors near courtrooms. Access to the law enforcement waiting area must be secure. Provide couch, chairs, and a table.
- Victim Waiting: Victim waiting areas must be located off public corridors near courtrooms. Provide chairs and a table. This room may be used for remote testimony to the courtroom. Provide power, lighting and configuration to allow audiovisual equipment to obtain proper images.
- Court Interpreters Convenience Center: Interpreter waiting areas must be located off public corridors near courtrooms. Provide bullpen with lockers, carrels, tables, manager's office, shared phones, secure storage, and a TTY machine.
- Blood Draw/DNA Swab Room at Family Court: Provide a chair and locked cabinet.
- Fingerprinting: Provide a pass-through to the Family Law clerk's area. Provide space for a telephone booth sized-machine. Provide a desk and a camera area to take headshot photos. Locate adjacent to Criminal Court, with a secured door.
- Government attorneys: Local Child Support Agencies often meet with litigants before and during child support calendars to try to reach stipulations. Given the high volume of these calendars, large conference room should be available with computers and printers available to calculate child support and print out agreements.
- Resource room for Social Services: locate near courtrooms so that litigants who are referred to social services can get immediate assistance for problems such as substance abuse.

8

IN-CUSTODY DEFENDANT RECEIVING, HOLDING & TRANSPORT

Control Room

Kane County Judicial Center
St. Charles, IL
HOK Architects

8. IN-CUSTODY DEFENDANT RECEIVING, HOLDING, AND TRANSPORT

Criminal courts must have secure facilities to receive, hold, and transport in-custody defendants to and from the courtroom. In small court facilities, this may amount to a few holding cells and a secure corridor to the courtrooms. In urban criminal court facilities, this consists of a large receiving and detention facility accommodating hundreds of in-custody. Similarly, family and juvenile court facilities must maintain safe and secure movement of in-custody defendants.

8.1 OBJECTIVES

Provide safe and secure transportation for in-custody defendants to courtrooms by means of a system of secure elevators and corridors.

8.2 DESIGN CRITERIA

The functional components of in-custody defendant receiving, holding, and transportation areas include: vehicle sallyport, security vehicle parking, pedestrian sallyport, initial holding cells and search area, control center, central holding cells, booking station, kitchen and lunch storage, dress-out, property and clothing storage, attorney interview space, secure elevators and corridors, courtroom holding cells, bail and fine payment counter, and storage rooms.

Many in-custody spaces are addressed in California Code of Regulations, Title 24. All in-custody areas must meet the requirements of, and obtain approval from, the State Board of Corrections. Since these regulations are subject to change, this section shall be reviewed along with the most recent edition of Title 24 prior to beginning project design.

The following planning and design criteria shall apply:

Vehicle Sallyport

Provide an entry point into a secured vehicle parking area to allow access and egress of vehicles transporting in-custody defendants. Provide a secure access gate, and a second egress gate. An officer in the control center shall electronically activate the gates. The gates shall accommodate a bus or a large van.

Security Vehicle Sallyport and Parking

Provide a security vehicle parking area to allow law

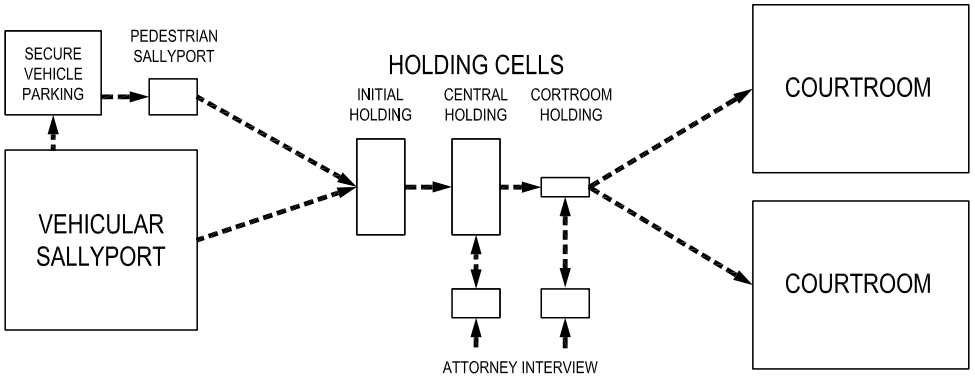


Figure 8.1 Diagram of Holding Areas

enforcement vehicles to park and unload in-custody defendants. This area shall include a wall-mounted gun locker, a temporary hold cage, and a handcuff rail.

- The size and configuration of this area will vary depending on the number of in-custody courtrooms. If the primary detention facility is joined to the courts by a tunnel or a secured walkway, this area may include parking for one or two sedans. If the jail is some distance away and the facility is a major criminal court, the area may require parking for several large-capacity buses, vans, and sedans.
- Provide CCTV camera, duress alarm and voice monitor.

Pedestrian Sallyport

The security vehicle parking area is entered and exited through a pedestrian sallyport. Provide a sallyport to hold two to six individuals. This area shall contain two electronically controlled doors, one of which is closed before the other is opened. These doors shall be remotely controlled with voice and video connection to the control unit.

Initial Holding Cells and Search Area

The initial holding cells and search areas for in-custody defendants shall include a counter for filling out forms, metal detector, railing to secure handcuffed defendants, and benches for defendants to sit. One or more cells shall be provided to house defendants. These cells must be designed in accordance with the current requirements of California Code of Regulations, Title 24.

- Provide voice monitors, closed circuit television cameras with optional event recording, and silent duress alarms with video enhancement in these areas. Cameras must be located where the inmate will not be shown in the restroom area.

Control Center

The control center will vary in size, depending on the size of the court facility and holding areas. This area may be the security control center for the facility.

- In large court facilities, a fixed-post control center may be required to monitor the flow of in-custody defendants through sallyports, cell doors, and controlled access and egress points. Locate the control center to visually monitor lockup area corridors.
- The control center shall include electronic door control panels, video monitors and related equipment necessary to maintain supervision of the holding area and the court facility.
- In large court facilities, the control center monitors all cameras throughout the facility, as well as the duress alarm system.
- Provide security-glass windows to enable staff to observe the holding areas.
- Consider adding a lock-up area, separate from offices. Walls shall go to the underside of the floor above.

Weapons locker

A secure weapons locker shall be located outside the security perimeter of the facility such that no officer shall bring into the security area any weapon. Such weapons lockers shall be equipped with individual compartments, each with an individual locking device. Weapons lockers are required in temporary and court holding facilities.

Central Holding Cells

In-custody defendants awaiting a court hearing or trial may be held in a central holding area before being transported to the courtroom or holding rooms adjacent to the courtrooms. The central holding area will vary from a few cells to a large number of single and multiple occupancy cells. Holding cells shall be designed to prevent visual contact between in-custody defendants in holding cells across from or adjacent to each other. Separate holding areas for males and females shall be provided. If juveniles are held in the facility, their cells shall have sight and sound separation from the adult section. Consideration shall be given to separating gang members, serious offenders, and special care defendants.

These cells must be designed in accordance with the requirements of California Code of Regulations, Title 24. However, the most recent version of applicable code requirements shall be used during design.

- Group cells accommodating up to 16 people shall be provided. In accordance with California Code of Regulations, Title 24, holding cells must contain

a minimum of 10 NSF of floor area per inmate and be no smaller than 40 NSF, with a clear ceiling height of eight feet minimum. Each holding cell must have a water closet, washbasin, floor drain, drinking fountain, and adequate seating for all inmates. Individual cells must include a toilet, sink, and drinking fountain. A clear ceiling height of eight feet must be provided in all holding cells.

- Cells shall have structural glazed-concrete block walls with an anti-graffiti coating. Single and group cells shall have wall-mounted metal or concrete benches. The sink and water closet unit may be combined and have modesty panels. Plumbing fixtures shall have anti-flood devices. Provide acoustical security ceiling, security sprinkler heads, security light fixtures and a separate HVAC zone.
- Voice monitors and color closed circuit television cameras with optional event recording shall be provided in the central holding area. Consider providing threshold monitoring tied into the Control Center.
- Large court facilities may have a attorney interview space (see criteria below) accessible from the central holding area.
- High volume or arraignment court facilities may require a staffed station in the holding area.
- Consider providing an outside area for inmates in case of an emergency. This area must be secured in case of evacuation.

Booking Station

Provide a booking station in the central holding area or central security administration area for formal booking of an individual who is not in custody.

- Provide detention facility finishes and furniture.
- Provide space for a digital photography unit, fingerprint scan station, booking terminal, and equipment utilized by the law enforcement agency.

Kitchen and Lunch Storage

Provide an area to store lunches for defendants who are spending a full day at the court facility. This area may serve the food services needs of security staff.

- Provide refrigerated storage, a sink, and a general storage area. Area size shall depend on anticipated occupancy of the holding cells and number of staff.
- In large facilities, this area may include tables and chairs for staff breaks and lunch, vending machines, a coffee area, and storage.

Dress-out, Property and Clothing Storage

Provide an area for the defendant to obtain civilian clothing and dress-out. An in-custody defendant may need to dress in nondetention clothing for a court appearance. Usually dress-out occurs at the jail before transportation to the court facility. Occasionally, clothing may be delivered to the court, or other circumstances may require dress-out at court. An adjoining storage area shall be provided for detention clothing.

Safety Equipment Storage

A secure area shall be provided for the storage of safety equipment such as fire extinguishers, self-contained breathing apparatus, wire and bar cutters, and emergency lights.

Janitor's Closet

At least one securely lockable janitor's closet, containing a mop sink and sufficient area for the storage of cleaning implements, must be provided within the security areas of the facility. In court holding facilities, the closet need not be in the security area.

Attorney Interview Space

Provide private and secure rooms for attorney and defendant interviews and conferences. Locate spaces at the central holding area and on court floors adjacent to courtroom holding cells. Entrance on the attorney side shall be from the nonsecure public side. The room shall be divided by a security panel, with contact space to permit review and signing of documents. Separate the in-custody side of an interview booth with a door from holding cells to promote confidentiality.

- Provide acoustical treatment to minimize sound transmission, since conversations held in these rooms are confidential.
- Provide detention work surfaces and stools, structural glazed-concrete block walls, vinyl floors, and

vandal-resistant lighting fixtures and ventilation openings.

- Provide closed circuit television cameras with optional event recording in these rooms.

Secure Elevators and Corridors

Access from central court holding to courtroom holding can be either through a secure corridor or by a secure elevator. In medium to large court facilities, a number of secure elevators may access holding cells between courtrooms on multiple floors. See Chapter 2, Court Organization, for vertical and horizontal circulation descriptions.

- Provide voice monitors and closed circuit television cameras with optional event recording.

Courtroom Holding Cells

Each criminal courtroom shall have access to one in-custody holding cell directly adjacent to the courtroom. Arraignment and high-volume criminal courtrooms may need several single and multiple occupancy cells. The court security officer shall be able to access these cells from a separate courtroom entry point. Similarly, in civil court facilities, at least one holding cell shall be provided in a secure area.

At least one holding cell in the court facility shall be equipped with a loudspeaker to allow auditory monitoring of courtroom proceedings. This cell could be used for disruptive defendants unwilling to participate appropriately in the trial process.

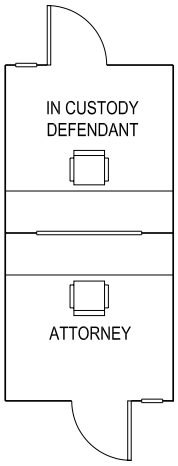


Figure 8.2 Attorney Interview Area

Bail and Fine Payment Counter

Provide a counter for payment of fines and posting of bail for individuals to be released from central holding. In many jurisdictions, this occurs at the court clerk's office. Sometimes central holding maintains the counter. This area shall be accessible from a public corridor, have a secure window, and include a terminal, printer, and cash deposit unit. Security provisions shall include a closed circuit TV camera, monitor, and silent duress alarm.

8.3 FUNCTIONAL RELATIONSHIPS

A secured vehicle sallyport and a pedestrian sallyport shall be the primary means of access and egress for defendants entering or leaving the court facility. Access into secured corridors for transport of detainees to and from court shall be by remotely controlled electronic locks. The in-custody defendant holding areas shall be centrally located between the defendant receiving area and courtrooms.

In multistory courthouses, holding facilities may also be located between courts and accessible by secured corridors, stairs or elevators. A separate secure exit stair for courtroom holding occupants is not a requirement; operational procedures for existing in- custody defendants during an emergency must be determined for each court building to confirm that a separate exit pathway is not required. Courtroom layout, function and security requirements determine proper placement.

Consider providing an exit area for released inmates. Provide CCTV and voice monitor to control inmate departure.

8.4 DESIGN CHARACTERISTICS

The materials selected for in-custody defendant receiving, holding and transportation areas shall be extremely durable.

- All furniture, lighting fixtures and ventilation shafts inside holding cells shall be vandal-resistant and secured in place. Seating must be designed to the level of security. When bench seating is used, 18 inches of bench is seating for one person.

- All surfaces that are accessible to defendants, except stainless steel, shall be treated with an anti-graffiti coating.

- Walls shall be constructed of solid, impenetrable construction such as structural glazed-concrete block with solidly grounded rebar. Ceilings shall be an impenetrable security acoustic panel system.

- Lighting: Lighting shall not be less than twenty foot-candles at desk level. Lighting shall be centrally controlled and/or occupant controlled in housing cells or rooms, with no light switches in secured corridors or holding areas.

- Audio or video monitoring system: In court holding facilities housing inmates classified higher than minimum security, there must be an inmate actuated or sound actuated audio monitoring system which is capable of alerting personnel stationed in a central control point. When visual electronic surveillance is used, it shall be located primarily in hallways, elevators, corridors or at points on the security perimeter such as entrances and exits.

- Emergency power: There shall be a source of emergency power in all detention facilities capable of providing minimal lighting in all housing units, activities areas, corridors, stairs and central control points, and to maintain fire and life safety, security, communications and alarm systems. Such an emergency power source shall conform to the requirements specified in Title 24, Para 13, Article 700, California Electrical Code, California Code of Regulations.

- Water closets: In temporary holding cells or rooms, and in temporary staging cells or rooms, water closets shall be available on a ratio of one water closet to every sixteen inmates or fraction thereof, but not less than one water closet to serve any holding cell or room. One urinal or two feet of urinal trough may be substituted for each water closet up to one third of the total number of water closets required, except in those facilities or portions thereof used for females.

- Wash basins: In temporary holding cells or rooms and in temporary staging cells or rooms, wash basins shall be available on a ratio of one wash basin to every sixteen inmates or fraction thereof, but not less than one wash basin in any holding cell or room.

- Drinking fountains: Provide a minimum of one drinking fountain in every single-occupancy cell and dormitory. Additional drinking fountains shall be located in other areas of the facility so that drinking water will be available to inmates and staff.

9

PUBLIC SPACES

Public Entry

City of Tempe PoliceCourts Building

Tempe, AZ

Gould Evans Associates

9. PUBLIC SPACES

Public spaces provide courthouse visitors with a first impression of the justice system and the court facility.

9.1 OBJECTIVES

Strategically placed, clear and legible graphics and signage, visible upon entry, will provide first-time visitors with information about where to find various functions and how to get there. Wayfinding techniques shall provide visual cues about location of important public spaces and services.

The court facility must maintain a safe and secure environment for all people and property within the courthouse spaces. Court security includes active and passive measures, encompassing design, technology, and operations. See Chapter 4, (Courthouse Security).

9.1 DESIGN CRITERIA

The following design criteria shall be used to design public spaces.

9.2 PRIMARY BUILDING ENTRANCE

The front door of each court building has important symbolic and functional attributes. This main ceremonial entrance is the single point of entry for staff, visitors, and the public. Staff-only entries may be designated.

- Provide a single primary entry with universal access, in compliance with ADA standards.
- Design the entrance and entrance doors to accommodate peak hour lines of prospective jurors and courthouse visitors. Lines may extend out the door. Provide a canopy covering outside. Some climates may require a vestibule. Refer to Chapter 11 (Architectural Design Criteria).
- Building entries, especially the main public entry, must accommodate persons with disabilities in the same manner as the general public. Entry doors shall meet the closer requirements of applicable codes. Power assist doors or balanced doors shall be provided. Power assist doors are preferred because they can be used only when needed, but are a universally accessible solution.

9.3 PUBLIC LOBBY

The public lobby serves as the focal point for the building and provides visual orientation to the other areas through visual cues and signage.

- Provide a public lobby sized to accommodate a queuing area and weapons screening station(s).
- Provide clear signage and graphics immediately upon arrival in the courthouse public lobby. Many courthouse visitors will require directions to court-

Figure 9.1 Public Lobby, Murrietta Riverside Superior Courthouse, Riverside

rooms or hearing rooms. Provide large, easily readable court calendar monitors. Areas where courtroom assignments are posted must be accessible without impeding the security screening process or blocking public circulation paths.

- Provide climate and glare control.

Security Screening Station

Building users and nonexempt staff shall enter the facility through a public entry screening station. Screening of the public occurs between the exterior entrance and interior rooms, corridors, elevators or stairwells. Screening stations shall include space for the following:

- An interior or covered area for queuing of the projected peak volume of people entering the building, between the security screening station and the building entrance, not less than 20 linear feet.
- A magnetometer, or metal detector, through which visitors pass for detection of metal objects.
- An X-ray scanner for screening contents of visitor briefcases, handbags and personal possessions.
- A table or counter for secondary inspection of scanned items.
- A magnetic wand inspection area.
- Security staff posts to assist individuals through the magnetometer screening and X-ray scanning.

Figure 9.2 View of Screening Station, Murrietta Superior Courthouse, Riverside

In multi-portal screening areas, a third security post may be needed to oversee the screening process and assist security staff.

- Design the screening area to be consistent with the court public spaces, and project a positive first impression to court visitors. Provide a casework screen for the scanning position, constructed of durable materials to withstand the stress of a high-traffic area, and lined with nonricochet, bullet-resistant material, which will absorb multiple firings of a large-caliber handgun.
- The accessible path of travel shall include the lobby security screening area. Wheelchair users shall not travel a separate and unequivalent path through the screening process and area. Persons with disabilities will pass through a magnetometer, along with the general population. The magnetometer's 32-inch clear opening will accommodate wheelchairs and scooters.
- Involve the sheriff's department or court security officers during the early planning and design phases, to ensure compliance during equipment installation.
- Provide one security screening station, or lane,

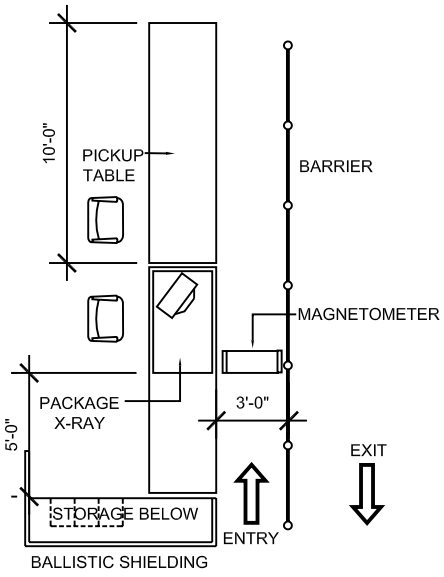


Figure 9.3 Single Lane Screening Station Diagram

for full time operation. Provide additional lanes as required to operate during peak usage, during mornings and after lunch.

- Provide power, data and voice communications to the security post.
- Provide gun lockers for law enforcement officers entering the facility, consistent with local security procedures.
- Design each security screening area to allow visual observation by security staff of all of public exits to ensure that individuals entering the building do not circumvent the screening process. Directionally sensitive motion-detection systems may be used to provide an alarm notification of the entry of individuals through the exits.
- Staff-only exits not located at staffed security screening stations shall be electronically monitored and alarmed. Use video cameras to continuously record activities at the public exits and to provide secondary monitoring by the command center security staff. Position power and data outlets for each camera location, considering lighting and glare to ensure that the user is not silhouetted and that picture quality is effective.

9.4 INFORMATION KIOSK OR COUNTER

A clearly identified information kiosk or counter may be used to provide direction and basic information to individuals unfamiliar with the court facility or court system. The kiosk or counter must be located in a highly visible place near the main entrance but beyond the screening area. Design the information area consistent with the public spaces.

The information area must be used in conjunction with directional signage to provide courthouse visitors information about referrals to and location of services.

If a kiosk is used, it may be an automated system with touch-screen technology, or a combination of automated signage with a staff member so that the kiosk still provides information if the staff member is not present. If the counter is staffed, provide adequate accessible workspace. Staff may be volunteers.

9.5 COURTROOM PUBLIC WAITING

Public waiting areas shall include sufficient comfortable seating and be located near areas of highest public use, with easy access to restrooms and water fountains. Waiting areas shall be proportional to the population served. Provide natural light in waiting areas when possible

- Corridors may be used as public waiting areas if they are wide enough to accommodate bench seating and if a vestibule with a sound lock is provided at courtroom entrances.
- Provide sufficient space and power for a temporary magnetometer to be located in each vestibule at each courtroom entry.
- Family Law, Arraignment and Juvenile courts require a larger public waiting areas.

Figure 9.4 Information Desk, Vista Courthouse, San Diego

10

BUILDING SUPPORT SERVICES

Loading Dock

San Francisco Civic Center Courthouse

San Francisco, CA
RossDrulisCusenbery Architects
Hood-Miller Associates
Mark Cavagnero Associates/ John M.Y. Lee

10. BUILDING SUPPORT SERVICES

Building support services ensure necessary routine maintenance and operational functions occur on a daily basis within the court facility. Support services include deliveries, collection and removal of trash or recycled materials, and storage of fixtures, and equipment.

The character and size of building support spaces shall be determined during programming and early design phases, with input from the Office of Court Construction and Management (OCCM) building operations staff.

10.1 OBJECTIVES

Plan service spaces to improve efficiency and lower court building operational costs.

10.2 JANITOR CLOSETS

Provide janitor closets on each floor of the court building, except for small facilities, or floors with limited occupied spaces. Provide a service sink, tool racks, and wall mounted shelving.

In large facilities, provide a janitorial storage room for central inventory of supplies. Locate near staff locker rooms and management office.

10.3 LOADING DOCK

Large facilities require a raised loading dock to accommodate deliveries, trash, and recycling trucks. Interstate large trailer rigs need not be accommodated in the loading dock. The building location shall allow easy delivery and efficient distribution of goods throughout the facility.

- Locate the loading dock near the freight elevator but away from general office areas of the court.
- Locate air intake ducts to avoid intake of fumes from idling trucks.
- Provide a staging area so that all deliveries can be scanned or examined prior to entering the building.

Access from the street must be through a restricted vehicle circulation. The driveway, loading dock, loading dock apron and any exterior staging areas must be within the security perimeter and fully enclosed by fencing.

Provide closed circuit television to monitor the driveway, loading dock, loading dock apron, and exterior staging area. Provide telephone or other annunciation system at the gateway to the service driveway. If the gate is remotely operated, provide a manual backup system. Refer to Chapter 4, Courthouse Security.

Paper and office supplies can be delivered on an as needed basis. Provide space for palette delivery and storage near the loading dock

Dedicate one truck bay within a secure loading area to refuse and recycling. This area will include collection and compaction bins, and locked, covered roll-off containers. This bay will include a covered area for temporary storage of delivered supplies, equipment, and recyclable materials.

- Provide a file shredding area near the loading dock. If this process is contracted out, provide a secure area to store materials awaiting pickup.
- Provide a 10-foot by 10-foot area for used copier/printer cartridge storage.

10.4 NEWS MEDIA FUNCTIONS

The courthouse must accommodate the media, inside and outside the facility.

Interior Media Area

Provide an interior space off a public corridor, not necessarily near the courtrooms, with appropriate power, data, and telecommunications support systems, including audio, video or other feeds to the main distribution frame. The media room may be multipurpose, but must be available for the news media in courthouses, especially during high-profile cases.

Exterior Media Area

Designate an exterior area with parking for multiple satellite trucks. The area must face south for satellite exposure. The location can be beyond building security standoff. For urban areas where no parking that can be designated for satellite trucks, provide an exterior connection box for video and audio accessibility on the south side of the building or at the loading dock.

10.5 MAILROOM

Most facilities receive daily packages and mail through the public entry, where they are scanned by the x-ray machine. A large facility may require a dedicated mail opening room with biohazard control capabilities.

Locate the mail room and mail opening room near the central receiving or loading dock and near a service or freight elevator, to allow staff to transport mail to other parts of the building.

10.6 MAINTENANCE SHOPS AND OFFICE

Provide an office for court-based maintenance staff. The office shall be sized to accommodate workstations for project and facilities management staff, and space for visitors. Provide furnishings for storing and reviewing building plans, and reference catalog shelving. Locate a staff restroom for easy access by maintenance staff. Locate the office in the basement or in a non-public location.

In large facilities, locate a maintenance shop on the ground floor, near the freight elevator. Provide walls to minimize noise transmission.

In large facilities provide a lunchroom for custodial workers.

10.7 STORAGE

Provide a furniture storage area in medium and large facilities, near the freight elevator. Building supplies and materials, such as carpet, shall be stored there.

DRAFT
August 3, 2005

11

ARCHITECTURAL DESIGN CRITERIA

Courthouse Entry
Robert A. Christensen Jutice Center
Castle Rock, CO
HOK Architects

11. ARCHITECTURAL DESIGN CRITERIA

The architectural design criteria provide performance standards for selected architectural components, building assemblies, and finishes.

11.1 OBJECTIVES

The performance standards and design criteria listed in this chapter provide functional solutions to objectives listed in Chapter 1 (General Principles); design excellence, sustainability, physical durability and functional lifespan, and energy efficiency.

11.2 DESIGN CRITERIA

California court facilities shall use quality materials and finishes in all elements, and exhibit consistency in the design throughout. The performance of architectural elements shall be consistent with the functional lifetime defined in Table 1.1 (Functional Life of Building Components or Assemblies), and the selection of elements, systems, or materials shall be consistent with the construction budget.

11.3 BUILDING ELEMENTS: EXTERIOR CONSTRUCTION

Design the exterior building envelope, including roofs, exterior walls, foundations, retaining walls, and door and window assemblies, to be weatherproof. Design to exclude leaks and other defects for all moisture protection systems, including: exterior sealants, vapor barriers, under slab moisture barrier systems, exterior cladding systems, roofing, and waterproofing. All window design must anticipate water infiltration and condensation, and provide means to direct water to the exterior.

Wind Analysis

The forces of wind and weather shall be considered in architectural design. A pedestrian level wind analysis may be required to determine wind effects, on the court building and surrounding buildings, sidewalks, plaza and entrances, to determine the need for a main entry vestibule. The recommendation of a wind analysis shall be addressed by the architectural design. Snow and ice accumulation analysis may be required for court buildings in cold regions of the state. An air quality wind analysis may be required to determine the optimum location of air intakes and exhaust stacks.

Exterior Building Walls

The exterior wall design shall present a consistent image, character, and permanence. The design shall include architectural detailing, including use of different materials, textural inlays, wall plane articulation, and pedestrian level detail. Scoring, control joints, and other wall plane relief shall be considered and incorporated into the design. The building cladding system requires high quality, long lasting, durable components that can accommodate movement, are designed for low maintenance and have a functional lifetime defined in Table 1.1 (Functional Life of Building Components or Assemblies).

- Moisture and Damp Proofing

  Provide an exterior envelope system, including roofing, that is a complete weather and moisture proof assembly that will prevent infiltration into the building's occupied or unoccupied areas. Design the building to prevent the introduction or long-term growth of mold or other pathogens that could adversely affect the indoor environmental quality or work environment. Provide a complete moisture and damp proofing system at all concrete slabs on grade, retaining walls, and other below grade structures. No wooden elements shall be exposed to rain.

- Barrier Walls and Drainage Plane Walls

  The defining feature of a barrier wall is that protection from sun, water and wind is provided

at the single outermost surface of the wall, the system repels water at the same surface that faces the environmental forces. In contrast, a drainage plane or cavity wall has a primary water resistant layer behind the exterior surface, which provides the environmental protection, and a secondary water barrier.

Traditional barrier walls rely on mass to absorb moisture and evaporate it slowly to the exterior and on physical shielding, such as roof overhangs, window setbacks, and drip edges, to protect vulnerable joints from weather exposure. Typical exterior materials include cast-in-place concrete and cubic stone.

Contemporary surface barrier walls rely on the surface material or coatings, and sealant joints, to keep water at the exterior. Such walls have little mass, physical shielding or redundancy. Typical exterior materials include: thin stone or ceramic tile, brick, pre-cast concrete panels, concrete masonry units, and composite metal panels. The reliance of contemporary barrier walls design on a single water resistant barrier and on superior construction craftsmanship has made their performance problematic. Since the consequences of leakage thorough the exterior of court buildings are unacceptable to AOC, exterior walls of new court buildings shall be designed as drainage plane or cavity wall systems, regardless of the primary exterior surface material.

Drainage plane walls shall provide internal drainage by using separate surfaces, or planes, for water protection and for environmental protection. The water protection layer, made up of a weather resistive barrier (WRB) and flashings inside the wall behind the exterior finish, provide an initial weather protection barrier. These walls recognize the inevitability of water entry past the outermost exterior plane.

Components of a drainage plane wall are:

- Exterior veneer and seals: sheds most water; protects the WRB from sun and excessive water exposure;
- Air space: separates the inner and outer walls, provides a drainage pathway, and drying of veneer anchors and weather barriers;
- Flashings: interrupts the downward flow of water and directs it to the outside; flashings are located at all wall penetrations; are transverse to the WRB, extending to beyond the veneer, sloped to drain, and panned-up at inboard edges.

- Cement Plaster Cladding Systems

  Cement plaster exterior walls can function as a modified drainage plane wall. The following standards and criteria shall be used for the design of cement plaster cladding for building envelopes. This system can be expected to have a service life similar to other cladding systems.

  Conventional exterior Portland cement-based plaster cladding is an allowable cladding system for a court building of one or two stories. Use of cement plaster cladding for buildings greater than two stories requires special considerations and AOC approval.

  Cement plaster cladding for court buildings shall consist of three layers of cementitious material with a total thickness of 7/8-inches, applied to lath that is installed over a weather resistive barrier. The exterior plaster functions as a modified cavity wall. Water that penetrates through the exterior plaster is captured by a secondary weather barrier and drained to the outside through weep screeds, drainable control joints, and flashings. Plaster protects the secondary weather-resistive barrier from direct exposure to environmental elements and degradation. The cement plaster cladding shall inhibit the majority of moisture covering the exterior from reaching the secondary weather-resistive barrier. The secondary weather-resistive barrier and the flashings are intended to accommodate only incidental amounts of moisture.

  Standard Cement Plaster Wall Assembly: The following system shall be a guide to architects and specifiers for the design of cement plaster exterior cladding. Beginning at the exterior framing, the components are:

  - Exterior grade gypsum sheathing with non-organic facing: if plywood sheathing is used for structural purposes, over the framing, it shall be ¾-inch pressure-treated. Oriented strand board is not an acceptable sheathing for cement plaster cladding;

- Metal or pre-molded plaster flashings, control, expansion joints, and other accessories;
- Weather resistive barrier;
- Metal lath;
- Base, or scratch, plaster coat, 3/8-inch thick
- Second, or brown, plaster, 3/8-inch

Weather Resistive Barrier: A building clad with exterior plaster must be completely weather-resistive prior to the installation of cement plaster. Completely weather-resistive barriers include all surfaces that are to be covered by the plaster, all penetrations, such as windows and doors, and all terminations, such as parapets and the base of walls.

Weather-resistive barriers (WRB) for exterior plaster cladding are required, consisting of two layers of self-adhesive sheet membrane or one layer of Grade D 60 minute building paper and one layer or more layers of self-adhesive sheet membrane. The choice of WRB material will depend on project conditions, including sheathing material.

The two-layer barrier allows a relatively unimpeded downward flow of moisture over the weather resistive layer, even if the plaster bonds to the first weather resistive layer. The numerous fasteners needed to hold the lath in place make a two layer WRB a two layer barrier necessary, as damming created by the adhesion of the plaster to allow for water entry through the fastener holes.

Before specifying a WRB material the designer shall perform a computer-aided check of the transitional moisture vapor flow through the wall for a minimum two year cycle, beginning at the end of construction, to ensure that the vapor impermeable barrier will not cause the accumulation of moisture in the wall cavity leading to interior condensation.

(The above is taken from a paper: Kenneth E. Klein P.E, "Cement Plaster Cladding Systems For Building Exteriors," Simpson Gumpertz & Hager Inc., Consulting Engineers, 2005.)

- Flashing

  Concealed flashing systems which cannot be easily replaced shall be permanent, stainless steel, copper or other metal flashing systems not subject to corrosion. Provide flashing systems consistent in material, detail, scale, and quality with the facility design. If flashings are exposed, they shall be designed utilizing materials consistent and harmonious with the design intent.

- Expansion Joints

  Develop the structure to limit movement, and the requirements for expansions joints. Where required, design expansion joints to be minimally visible, and watertight. Joint cover assemblies shall meet all code requirements for impact, loading, and fire protection.

Exterior Building

- Windows and Doors

  Provide the best-proven institutional-grade window systems. Glazed entry systems shall be constructed of colored or finished aluminum or other metal systems. All glazing shall be insulated units for optimum thermal and acoustic performance tinted or coated as required. Windows shall be fixed or operable, consistent with sustainability standards.

  Architectural curtain walls are a special class of drainage plane wall with pathways, flashings and sealants internal to the framing elements. For this reason, the engineering, detailing, testing, and construction of glass and metal curtain walls for California court buildings shall follow the highest recommended industry practices.

  Consider operable windows for certain areas to support a sustainable design objective. Small operable windows may not significantly impact mechanical system performance depending on size and quantity. Large operable windows may adversely impact building and space pressurization and temperature. The use and specification of operable windows shall be coordinated with HVAC system design and be consistent with the court facility security plan.

  Public entrances require doors that are easy to operate in a variety of environmental conditions.

Balanced swinging doors, power assisted swinging doors or power activated sliding doors are appropriate for courthouse public entries. Certain site environmental conditions may require vestibules or revolving doors to address site environmental conditions and to maintain interior comfort and cleanliness.

Provide aluminum, stainless steel or other approved metal institutional-grade door systems with matching frames for public entries. Painted aluminum frames and doors are not allowed for high volume entrances. Provide flush panel metal doors with welded steel heavy duty matching frames and institutional quality hardware and finishes at service and staff doors and frames. Hardware on exterior doors shall be stainless steel.

- Shading and Glare Control

  Control glare and heat gain at all work areas and public spaces. The glazing in the public lobby shall be mitigated for temperature and glare control so that security screening and any other staff can work and see monitors in comfort.

- Protection of Building Entrances

  Protect building entries from exposure to weather. Provide exterior canopies, building recesses or overhangs at all exterior entrances to protect doorways from exposure to rain and snow.

- Exterior Stairs and Ramps

  Often the entry levels of court facilities are raised above street level, which require universal access via permanent stairways, and ramps serving all courthouse users. Provide a system of guard and handrails of stainless steel, bronze or other permanent material that has a design and finish consistent with the facility design. Steel with epoxy finish coating can be used for guardrails and handrails not subject to high volume use.

- Walk Off Mats

  Walk off mat systems are required to improve indoor air quality through the reduction of dirt and dust tracked into the building, and reduce the maintenance of indoor floor coverings. Provide a system of exterior and interior walk off mats flush with the floor surface directly in front of the main entry doors and immediately after entering the public lobby. Mats shall be removable, cleanable, and replaceable. Minimum dimensions of walk off mats shall be the width of doorway, and nine feet in the direction of travel, on each side of the entrance doors.

- Exterior Flagpoles

  Provide two flagpoles, to accommodate a State of California flag and a United States flag near the courthouse public entrance.

Roofs

- Low Slope Roofing System

  The roof shall be weather tight and provided with a positive drainage that will effectively dispose of rainwater. The roof shall be insulated so that the heat transfer values from roof to occupied area comply with CCR Title 24, Part 2. Low sloped roofs shall provide a minimum of 1/4-inch per foot slope to drain along valleys. Roof drainage slopes shall be principally achieved by the elevations of the roof structure, not with fill material under the membrane. Dead level roofs are prohibited.

  Preferred roofing system: modified bitumen sheet roofing S.B.S. (Styrene-butidien-styrene) with mineral granular surface sheet, applied with hot asphalt, and reflective coating to achieve an "Energy Star" rating.

  The roof membrane will be replaced occasionally; to facilitate re-roofing relatively large un-interrupted roof planes are preferred. Mechanical and electrical roof top equipment and rooftop screens shall be designed to permit re-roofing in the future. Curbs and equipment bases on roofs shall be a minimum of eight inches high.

  Single ply roofing is not recommended.

  Roof drains shall be recessed below the roof level to form a collection basin; roof drain bodies shall be a two-part cast iron type that allows the waterproof membrane to be clamped between drain body parts, so that water infiltrating the roofing layers can drain into the system.

  Provide additional protection at walking surfaces for roof top service routes.

- Roof Top Equipment

  Roof top equipment shall be kept to a minimum. Locate equipment in rooftop penthouses and or behind visual screens. Integrate the location, size, and finish of rooftop penthouses and visual screens with the architectural design. Install critical rooftop equipment to permit roof system replacement without unreasonable disruption of equipment operation.

- Roof Access

  Provide an interior permanent dedicated industrial stair (not a ships ladder or ladder) and access hatches to the roof of all court facilities with roof slope of less than one to four. This stairway can be an extension of the building exit stair system. Provide access to the roof via the freight elevator if the roof includes significant mechanical equipment, which require regular maintenance or the transport of heavy replacement parts. Maintenance worker safety shall be a prime design consideration in development of roof access and roof parapets. The roof top access shall be of sufficient size to allow the transport of required tools and materials.

Building Maintenance

- Window Washing Equipment

  Multistory buildings require special facilities, which must comply with state regulations for regular maintenance of the exterior skin and window washing. Design the building exterior to accommodate safe, cost-effective window washing and maintenance procedures. Both operational and equipment costs shall be considered. Provide features necessary for maintenance worker safety. Provide required davits and sockets, tie offs, guardrails and re-locatable, motorized platforms to reach the windows on all building elevations. For low-rise buildings, provide a clear path ground level for motorized articulated lifts to reach to all exterior windows.

- Bird Roosting and Nesting Control

  Design exterior facades, and roof overhangs to inhibit bird roosting and nesting. Provide means of preventing bird roosting or nesting on horizontal surfaces greater than 6 inches deep, especially in protected or covered areas.

11.4 BUILDING ELEMENTS: INTERIOR CONSTRUCTION

The following design criteria shall apply:

Interior Building

- Day-lighting

  Balance the needs for security with openness, transparency, and natural light. Provide natural light to all primary public waiting areas, the main lobby, and work areas. Plan and design interior spaces to allow glare-free natural light in at all work areas. Develop methods to share glare-free natural light through the use of interior glazing, sidelites, borrowed lites, and light wells.

- Workplace Environment

  Provide a quality work environment that is conducive and suitable for performing the required tasks of the building occupants. Standards for lighting, acoustics, heating, ventilation, and air conditioning, and other building systems, shall be applied to enhance the work environment and to support a sustainable design objective. Design spaces to reduce energy and materials consumption.

- Floor-to-Floor Heights

  The standard floor-to-floor, or slab-to-slab, dimension for multi-story courthouses shall be 14 feet to 16 feet. Refer to Section 2.4 for requirements for relative building volume.

- Plenum Spaces

  Provide space above all finish ceiling areas for the HVAC supply and return distribution, electrical distribution, mechanical equipment, fire sprinkler systems, voice, data, low voltage cable, and other devices. Size plenum spaces to allow for future modification of these systems.

  Coordinate the size, access, and clearance requirements of systems located in plenum spaces with the depth of structural elements to allow required clearances for all systems to all parts of the building.

  Provide access to all plenum spaces for servicing all components. Provide access to plenum spaces above courtrooms for maintenance of utilities, and

to allow modification to cabling and outlets, which serve the floor above.

- Interior Partitions

  The minimum standard for steel studs in multi-layered gypsum wallboard assemblies is 20 gauge unless a lighter gauge is required for acoustical reasons. Comply with industry recommendations for deflection and span.

  Provide a system of concealed, permanent, secure, appropriately designed, backing, supports and anchorages for all handrails; wall hung cabinets, court seals, and other surface mounted fixtures, equipment, systems, and building specialties.

  Refer to Chapter 17 (Acoustical Design Criteria) for additional partition requirements.

- Ceilings

  Ceilings are an important visual feature of building interiors, and shall be designed for optimal visual, lighting, and acoustical performance. Refer to Chapters 15 (Lighting Design Criteria) and 17 (Acoustical Design Criteria). Courtroom ceilings shall have design attention equal to the vertical elevations of the room, but shall not distract attention from the proceedings. Integrate required technical features, with the use of ceiling soffits, coffers and materials to accommodate acoustical material, lighting, sprinklers, speakers, cameras, projectors, and projection screens.

  Judicial Officer Offices and Conference Rooms: Design ceilings to present a quality appearance and to integrate acoustic panels and lighting.

- Public and Private Toilet Rooms

  Public toilet rooms are heavily used and require durable, washable and easily maintained materials and finishes. For high volume public restroom entries consider the use of doorless vestibules with integrated sound and visual screening. Minimum finishes include: coved ceramic tile floors, glazed ceramic tile wall surfaces up to a minimum four-foot wainscot height, solid surface counter tops, under-counter mounted lavatories, stainless steel or monolithic plastic floor-mounted or floor and ceiling-braced institutional quality toilet stall dividers and doors, institutional quality toilet fixtures, institutional quality stainless steel toilet accessories, wall mounted mirrors behind the lavatory tops, diaper changing table in each restroom, gender specific fixtures, and semi gloss painted washable wall and ceiling surfaces.

  Provide a shower/changing area (for each gender) in a staff toilet room off the restricted corridor on the first floor of the building. The dressing area shall have wall-mounted hooks and a bench.

- Elevators

  If the project contains more than one floor or level change, the building shall include vertical conveyance systems. Courthouses typically require three elevator systems: public, restricted (staff) and secure (in-custody defendants). Public and staff elevators shall have an average service response time of 30 seconds or less and a handling capacity of 12 percent of the floor population served. All passenger elevators must meet the design requirements of the building code for access by disabled persons and emergency personnel. If high volume areas are located at any other level than the first, provide extra capacity to move large numbers of people to and from that level. If the project contains more than one floor or level change, a shared or dedicated elevator for staff, freight and service is required for deliveries, staff vertical movement, trash transport, document transport, and building maintenance. Staff elevators can double as a freight/service elevator.

  Hydraulic elevators are permitted for two or three-story facilities, while four-story and taller facilities shall have traction elevators.

  Passenger elevator car interiors shall have durable and vandal resistant finish materials consistent with the building design. Cab panels shall be replaceable. One cab in the building shall have an enclosure above the ceiling hatch to accommodate extra-long deliveries such as rolls of carpet. A typical car interior ceiling height is 9’-0” to 10’-0”

- Stairs

  Provide convenient stairs that encourage walking to other floors in support of the sustainable design objective by reducing demand on the elevator systems. Communicating stairs can be provided in both the public and restricted circulation system.

Required exit stairs shall be designed to encourage use by staff for normal circulation, with materials and finishes similar to the restricted corridors and introduction of natural lighting, when appropriate.

Provide a public connecting stair to access high volume public uses on the second and third floors of courthouses, in addition to elevator access. Design and finish open stairways that connect public lobbies to the upper floors in harmony with materials used in the public lobby. Pre-engineered steel stair and railing systems are acceptable for exit and communicating stairs (not for ceremonial high volume public stairs). Stair treads and intermediate landings shall be pan-type filled with concrete or terrazzo; channel or flat plate stairs stringers are acceptable. Provide architectural railings for communicating stairs; a standard railing system might be adaptable for this purpose.

- Doors Frames and Hardware

  Provide one-piece, welded steel doorframes at permanent locations requiring oversized or heavy doors or having significant traffic, including courtrooms.

  Provide pre-finished aluminum doorframes in partitions subject to periodic remodeling. Provide 12-inch to 18-inch wide tempered glass full height sidelights or glazed doors at private offices and conference rooms, except in judicial chambers, jury deliberation rooms and offices that require privacy.

  Provide security-grade hollow metal doors and frames and entrances to holding areas, security control rooms and secure evidence storage rooms.

  Provide flush solid core doors for typical interior conditions. Door construction shall meet or exceed AWI premium grade for courtrooms, custom grade for chambers suite offices, department entrances and private offices, and paint grade for all other doors. Courtroom public entrances may have stile and rail doors with vision panels.

  All hardware provided shall be institutional grade. Pins and hinges on all doors located on corridors, lobbies, atriums, and other public spaces shall be installed on the secure side of the door or shall be fixed. Latch and locksets shall be full mortised type; locks shall have removable key cylinders. Locks shall be grand-mastered, and master-keyed. Provide multiple keys for every lock type. Certain locks off master shall be specified. Hardware specified for courtroom use shall be of the highest quality and shall be selected for quiet, acoustically optimal operation. Selected doors require electric look sets or strikes and proximity reader card key locking systems.

- Courtroom Platforms

  Raised platforms in courtrooms shall be of a construction method not requiring underfloor fire sprinklers. Handrails, if required shall be discreet and integrated into courtroom design.

- Carpet

  Consistent with the expected functional lifetime, select carpet that is durable, low maintenance, and with 20 percent minimum recycled content. Specify carpet appropriate to the traffic expected in the space; courtrooms and offices are to be minimum 26 oz to 28 oz. loop pile and minimum 1/10 gauge; chambers are to be minimum 28 oz. cut pile and minimum 1/10 gauge. Specify nylon, olefin, or polyester products for durability with three-to-four-ply yarn. Loop pile is to be solution-dyed nylon.

  Specify a carpet available in broadloom, and carpet tiles to facilitate replacement. Broadloom shall be minimum 12-feet wide to minimize seams. Carpet tiles shall be standard 24-inches square. For higher acoustic values, specify urethane backed tile or urethane cushion on broadloom. Products must meet the Carpet and Rug Institute's standards for indoor air quality.

  Carpet on ramps or courtroom platforms shall meet wheelchair access requirements.

- Window Coverings

  Provide window coverings appropriate for visual screening, glare control, and use of work areas and courtrooms. Courtrooms with skylights, windows or borrowed light require window coverings to prevent glare, visual distractions, and light control during audiovisual presentations. Consider the exterior image of building when selecting the color

and materials of window coverings, to provide an image consistent with interior and exterior design intent.

Furniture and Fixtures

- Integrated Interior Design

  The design professional shall select, integrate, and coordinate the size, color, style, and finishes of movable furniture and equipment with the other interior elements.

- Modular Furniture and Workstations

  Modular Systems Furniture (MSF) is comprised of freestanding partition panels, worktops, files, components, and integrated circuitry and access raceways for provision of electrical power, voice and data cabling. The building shall be designed to allow for flexible rearrangement of MSF and connection to building systems. The electrical, telecommunications, data systems, and capacities must be designed to ensure compatibility with MSF design requirements.

- High Density Files

  Where required provide a mobile high density filing system. Locate on ground floor or adequately reinforced floor structure, near clerk's counter. Specify fixed rows for every six movable rows or as determined by AOC to allow access to multiple rows of files. Provide a locking feature for confidential files. Specify seven-shelf high cars. Filing system shall be accessible to persons with disabilities.

- State Seal

  Provide a metal or composite material of the official seal of the State of California in each courtroom, minimum size of 32-inches diameter; the appearance and location must reflect the dignity of the Court.

- Flagpoles

  Provide two flagpoles and holders in each courtroom, to accommodate a State of California flag and a United States flag. Flagpoles may be wall or floor mounted. Location shall not interfere with bench accessibility.

Interior Finishes and Materials

The Facility Standards specify four levels of interior architectural finishes corresponding to the component's target functional lifetime, required use, architectural importance, durability requirements, and surrounding interior context. Brief descriptions of example interior finish levels are provided below for reference; however the design professionals shall propose finishes for each project. See Table11.1 (Finish Matrix) for suggested finishes for the four levels.

- Level I Interior Finishes:

  Level I finishes are specified for building components with long functional life times and high aesthetic importance. Level I finishes have quality, long-term durability, ease of maintenance, and ability to sustain aesthetic appeal over a long period.

- Level II Interior Finishes

  Level II finishes are specified for high volume public service areas with mid-range functional lifetimes and increased architectural importance. Level II finishes offer mid-range durability, yet require regular maintenance and refurbishment, such as occasional repainting.

- Level III Interior Finishes

  Level III finishes are specified for building components with mid-range functional lifetimes and moderate architectural importance, yet require regular repair, maintenance, and refurbishment, such as repainting.

- Level IV Finishes

  Level IV finishes are specified for building components that may have long functional lifetimes. These are typically utility or support areas and have relatively low architectural importance. Level IV finishes are durable and maintainable.

Architectural Woodwork

Provide premium wood paneling and casework to convey a dignified appearance.

- Veneer Panels and Casework (Courtroom)

  Provide hardwood veneer panels with solid hard-

	Floor						Walls						Ceiling					Metal	
	Premium Carpet	Stone Tile or Terrazzo	Midgrade Carpet	Ceramic Tile	VCT / Linoleum	Sealed Concrete	Paneling (Wood or Stone)	Premium Acoustical WallPanels	Ceramic Tile	Painted Gypsum Board	Premium Base(Wood or Stone)	Rubber Base	Architectural Soffits	Premium Acoustical Panels	Midgrade Acoustical Panels	Painted Gypsum Board	Exposed Structure	Premium Clear Coated Metal	Ptd. Metal or Stainless Steel
Level I																			
Courtroom[1,2]	•	•	•		•	•	•	•	•	•	•		•	•		•		•	•
Public Lobby		•					•			•	•		•	•		•		•	•
Public Corridor		•	•	•	•		•			•	•		•	•		•		•	•
Public Restroom				•			•		•	•	•					•			•
Level II																			
Jury Assembly Room			•							•	•	•	•	•	•	•			•
Clerk's Public Counter		•	•							•	•		•	•	•	•			•
Self-Help Center		•	•							•	•		•	•	•	•			•
Child Waiting Area			•	•						•	•	•	•	•	•	•			•
Level III																			
Judicial Officer Private Office	•		•							•	•		•	•					•
Staff Office/Workstation			•							•		•			•				•
Jury Deliberation Room			•							•		•			•				•
Conference Room			•							•		•	•	•					•
Employee Breakroom					•					•		•			•				•
Staff Toilet				•	•				•	•					•				
Restricted Corridor			•							•		•			•				•
Restricted Communicating Stair			•	•	•	•				•		•				•			•
Copy Room					•					•		•			•				•
Level IV																			
Loading Dock						•						•					•		
Emergency Egress Stair						•						•					•		
Mechanical Rooms						•						•					•		
Telecom Equipment Room						•						•					•		
Storage					•	•				•		•				•	•		
Janitor Closets					•	•						•					•		

Table 11.1 Finish Matrix

1. Arraignment courts may have combination of carpet and hand surface flooring. Hard surface flooring might be appropriate under spectator bench seating.
2. Painting and gypsum board is appropriate above wainscot level in corridors and in combination with other materials in courtrooms. Painted gypsum board would be standard above tile in toilet room walls.

wood trim and edge banding, with shop applied stain and finish with three coats of transparent sealer per Architectural Woodwork Institute (AWI) premium grade requirements. Wood shall be from a certified sustainable source. The use of tropical hardwoods is prohibited. Solid wood base to match courtroom panels may be used in public spaces and chambers. Courtroom built-in components may include: Judge's bench, courtroom clerk's, court reporter's and bailiff's stations, jury box, public bench seating, counsel tables, rails and gates, and accessible lectern (note: bench seating, counsel tables and lectern may be standard furniture customized to match courtroom finish),

All other courtroom desktop work surfaces, whether modular or custom-built, shall be wood or plastic laminate with hardwood edges and fascias, in a non-patterned color harmonious with the courtroom decor.

- Cabinets and Casework

  Provide (minimum) AWI premium grade plastic laminate casework with ADA compliant base cabinets and plastic laminate tops.

11.5 SIGNAGE

Clear, legible, and strategically placed graphics and signage are essential design elements for a court facility. Signage directs visitors and staff to where they need to go, and contributes to a positive experience in the courthouse, by orienting users, and minimizing confusion. The many functions and high volume of daily users in the facility underscore the need for a successful signage program. Grouping too many signs in one place, at entries, lobbies and in corridors, is unsightly, results in confusion from first time visitors, and undermines the dignity of the judicial system.

All signage must meet the requirements of the Americans with Disabilities Act, and the most recently adopted provisions of the Uniform Building Code and California Code of Regulations, Title 24 regarding accessibility. Braille lettering and audio signals shall be provided at elevators and where required by codes. Provide prominent multilingual posting of public notices and informational.

An integrated, complementary, and comprehensive signage program shall address both code required signage (such as exit signs, exiting plans and room numbers) and non-code required signage (building directories, notices). The graphics and signage programs shall be developed during early design stages to integrate signage with the design concept, functional program, and building circulation zones. Attractive, legible signs showing directions and information shall be incorporated into design of all public areas.

Number rooms logically and consecutively to enable visually impaired persons to make assumptions about where their destination is located. Public room numbers shall be sequential and predictable. Base courtroom labels on a predictable sequence, not the internal administrative department labels. For example, a second floor courtroom shall be labeled Courtroom or Room 200, not Division 200.

Position room label signage at doorways, where sight-impaired persons expect to find information. Locate signage of building management rooms, which are not accessible to the public, in different areas than accessible signage. For example, locate electrical closet room numbers above the door, rather than to the side. Maintain brief, clear, and polite messages in signage.

The following guidelines shall apply to signage and graphics in various locations within the building:

Building Entry

Clearly mark the courthouse entrance with signs indicating all persons and articles entering the facility are subject to search, that no weapons of any kind are allowed within the facility or on the grounds of the facility, and that violators are subject to fine and arrest.

Restrict all other signage at entry to preserve a unified and attractive façade.

Building Directory

Locate a building directory near the main public en-

trance. The directory shall contain a diagram listing all major building components. This directory shall be located in an area seen by the public after they have been screened, and may be integrated into an information booth or kiosk. Provide smaller directories at each elevator lobby with information about various occupancies on that floor. Post signs for children's waiting room at each directory.

Court Calendar Postings

Provide a display of calendar information in the entry lobby so information can be viewed prior to the screening process. Larger courts shall provide wide screen digital monitors; smaller courts may use other means of information display. Calendar information may be displayed at courtroom entries. This display shall be uniform in appearance; postings shall be limited to the display area.

Public Bulletin Boards

A consistent, controlled system of freestanding or wall mounted bulletin boards shall be used throughout the facility to allow public postings. All computer generated signs, hand-written signs and notices will be restricted to these areas. Provide public bulletin boards in consistent, public locations to prevent staff from taping signs to walls.

Courtroom Entry Signage

All signs outside courtroom doors shall be of uniform appearance and integrated with calendar information displays. The courtroom numbering system shall be displayed at the top and in the largest font size. The judge's name shall be below, in a sign allowing nameplate modifications. All other signage will be posted on a bulletin board below, according to the needs of the court. No signage shall appear on courtroom doors except as noted. The design consultant shall work with court representatives to minimize signage.

Examples of court-specific signage include:

- Calendar postings
- Jurors and Witnesses Please Remain In Hallway Until Called
- Before Entering With Children, Please See Court Staff
- Closed Hearing
- No Cell Phones or Beepers

Courtroom Signage

Provide a consistent, controlled signage system within the courtroom to prevent individual postings by court personnel.

Examples of court-specific signage include:

- No Communication With Inmates. This sign shall be posted on the cage inside the courtroom facing the audience.

Other Signage

Provide a consistent, controlled system of other signs, such as restricted access warnings, directional signs, signs designating special handicapped services, and procedural guides. If high volume functions, such as the jury assembly room and the public counter, are not immediately visible from the entry lobby, clearly displayed graphics shall be prominently displayed to guide users to these areas.

12

STRUCTURAL DESIGN CRITERIA

Construction Photo

Jerry L. Pettis Memorial VA Hospital

Loma Linda, CA

Rutherford & Chekene Consulting Engineers

12. STRUCTURAL DESIGN CRITERIA

This chapter describes general and technical criteria for structural systems in new AOC buildings.

12.1 OBJECTIVES

Structural design goals for new courts facilities shall reflect functional and programmatic needs, adaptability for future technology and the ability to withstand potential damage from disasters and rare events.

Serviceability

The structure shall provide support for the intended occupancies, including floors of adequate level and flatness, stiffness, and vibration control from environmental and internal sources.

Adaptability

The structure shall be adaptable to local changes of use and occupancy or the installation of new information technology or mechanical, electrical, and plumbing systems due to changing technology. Adaptability features include: gravity systems with capacity to accommodate most non-specialized AOC occupancies, those that enable local strengthening, and those that facilitate additional floor and wall penetrations.

Performance in Rare Events

Most AOC facilities incorporate specialized features that will not allow relocation to alternative spaces without considerable preparation and alteration. Therefore, it is important to estimate the nature of damage that could be caused by rare, but possible events such as high wind, extreme snow, flood, and earthquake, and the possibility the building will not be available for occupancy for an extended length of time. The AOC shall determine the regional importance and any performance objectives above code expectations for all new facilities.

12.2 STRUCTURAL SYSTEMS

There are no specific limitations on use of gravity and lateral load resisting structural systems. The structural engineer shall submit written documentation to the architect describing how the recommended gravity load and lateral load system respond to the performance objectives.

New Technology

Structural components and systems not specifically covered by the applicable code are permitted for use, as an alternate means of compliance. Design criteria for such components or systems shall be reviewed by one or more peer reviewers acceptable to the engineer of record and the AOC, and shall be submitted to the AOC for approval.

12.3 DESIGN CRITERIA FOR SERVICE LOADS

The following design criteria and performance goals shall apply to courts facilities:

Live Loading

Minimum design load shall be 80 psf live plus 20 psf partitions, plus other appropriate dead loads. Areas that require heavier loading, such as libraries, storage areas, computer or communication rooms, and mechanical rooms, shall also be considered in the gravity floor design. Live load reductions shall not be used for horizontal framing components on each floor, transfer girders for columns, or columns supporting the roof or top floor.

Floor Vibration

Floors will be designed to control vibration from footfall to obtain slightly perceptible or better performance, as measured by the Modified Reiher-Meister

Scale (Murray, Thomas M., "Design to Prevent Floor Vibrations," Third Quarter, 1975, AISC Engineering Journal).

Vibration from reciprocating equipment will be controlled locally by isolation under the direction of others, such as the mechanical engineer, acoustical consultant or equipment supplier. The structural engineer shall confirm with the architect that there are no special requirements for the structure intended to minimize vibrations in the structure from sources other than footfall.

12.4 DESIGN CRITERIA FOR RARE LOADS

Earthquake

The Normal Seismic Performance of all new AOC facilities is intended to be above average for buildings designed in accordance with prescriptive code provisions. This will be achieved through design and quality assurance.

The AOC will designate specific buildings to be designed for Enhanced Seismic Performance. Enhanced performance refers to controlling earthquake damage to a building in order to limit the expected loss of use.

Normal Seismic Performance, Structural

Normal structural seismic performance objectives will be met by thorough conformance with the principles and provisions of the applicable code using an Importance Factor, I, equal to 1.0.

Normal Seismic Performance, Nonstructural Components

Acceptable performance of nonstructural components and systems shall be achieved by implementing code requirements during design and construction phases. An Importance Factor of 1.0 shall be used, except where higher values are required by the applicable code.

For each project, the AOC shall designate a Nonstructural Seismic Coordinator (NSC), knowledgeable and experienced in the seismic protection of nonstructural components and systems. The NSC may be in the firm of the Project Architect or Project Structural Engineer, or may be an independent design or construction professional. The NSC shall review and coordinate provisions in the construction documents that provide for seismic protection of nonstructural components as required by code. The NSC shall ensure that the construction documents contain provisions for protection, such as anchorage or bracing, that are clear, coordinated, and practical to implement. During construction, the NSC shall monitor the project to ensure compliance with seismic protection requirements and report noncompliance to the AOC.

Enhanced Seismic Performance, Structural

During preliminary design, the structural engineer shall develop detailed seismic design criteria to meet AOC seismic performance goals. Analysis and design methods shall explicitly account for nonlinear behavior (for example, as described in FEMA 356, *Prestandard and Commentary for the Seismic Rehabilitation of Buildings*). The AOC will review and approve the seismic design criteria, and may appoint an independent peer reviewer to review the design criteria.

Enhanced Seismic Performance, Nonstructural Components

Acceptable performance of nonstructural components and systems shall be achieved by implementing code requirements during design and construction phases. An Importance Factor of 1.5 shall be used.

For each project, the AOC shall designate a Nonstructural Seismic Coordinator (NSC), knowledgeable and experienced in the seismic protection of nonstructural components and systems. The NSC may be in the firm of the Project Architect or Project Structural Engineer, or may be an independent design or construction professional. The NSC shall review and coordinate provisions in the construction documents that provide for seismic protection of nonstructural components as required by code.

The NSC shall ensure that the construction documents contain provisions for protection, such as anchorage or bracing, that are clear, coordinated, and practical to implement. During construction, the NSC shall monitor the project to ensure compliance with seismic protection requirements and report noncompliance to the AOC.

In addition, the NSC shall identify equipment critical to continued building function and occupancy, as specified by the applicable code or the AOC. The

AOC shall determine requirements for prequalification of such equipment.

Blast

See Chapter 4 (Courthouse Security) for blast criteria.

Wind

Wind design shall be in accordance with applicable codes, unless otherwise specified by the AOC. Due to enhanced performance objectives or siting conditions, the AOC may select certain buildings for site-specific wind studies. This analysis will determine design parameters for the structural system, exterior cladding and ornamentation.

Snow

Parameters for design for snow loading shall be in accordance with requirements of the jurisdiction having authority..

13

MECHANICAL DESIGN CRITERIA

chapter photo

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HOK Architects

13. HVACR DESIGN CRITERIA

This chapter identifies the program and design criteria for Heating, ventilating, air-conditioning and refrigeration (HVACR).

The mechanical systems shall be adapted to support all performance objectives, typically involving sustainability, workplace performance (productivity and efficiency), equipment longevity, fire safety, and improved operations and maintenance.

The mechanical systems shall be specifically designed to function at full load and part load associated with all projected occupancies and modes of operation. To the maximum extent possible, system solutions shall also accommodate planned future occupancies and modes of operation. Special emphasis shall be placed on the design to allow for renovation, relocation, and creation of new courtrooms and adjunct facilities.

The design of the mechanical systems shall conform to the latest adopted version of the California Code of Regulations Title 24, Building and Energy Codes.

The mechanical and plumbing systems shall be designed to automatically respond to the local climatic conditions and heat recovery opportunities to provide cost effective energy conservation measures while assuring set point control.

The design of mechanical systems and other building components shall all combine together to produce a building that meets the project's programmed energy benchmarks.

The design shall include historical documentation of the capability and adaptability the selected equipment and systems proposed for a project.

The design solutions shall not sacrifice the basic needs of one program area to optimize another. Instead, the mechanical designs must optimize the program to assure attainment of all critical performance goals.

Maintainability and reliability are major concerns in facility operations. Design and installation of all mechanical equipment and components shall allow for removal and replacement, including major equipment such as boilers, chillers, cooling towers, pumps, motors, and air-handling equipment.

Standby capacity shall be designed into mechanical systems, enabling continuous services during repair or replacement of a failed piece of equipment or component. Redundant equipment shall typically not be designed into systems as stand-by units but rather shall be used as part of the operating system with equal time cycling through automatic control sequencing.

The choice of HVACR design concepts depends on code and regulatory compliance. The design shall provide a minimum, 25-year system reliability life cycle cost for equipment. The selection of energy efficiency measures shall be base on a maximum of 7.5 years return on investment.

13.1 OBJECTIVES

The criteria address equipment longevity, performance, reliability, first cost, maintenance and operating cost related to the mechanical systems. It is not the intent to discourage creativity. Design alternatives are encouraged early on in the design. Depending on the circumstances of project funding and project programming, life cycle analysis of several alternatives for HVACR systems may be necessary.

When comparative analysis is required, the concepts, systems and components favored by AOC must be among the alternatives analyzed.

The HVACR design shall employ energy-efficient design, consider life cycle costs and return on investment consistent with the project budget, and maximize incentives opportunities and funding assistance programs stimulating energy-efficient design. Design an energy-efficient HVACR system that exceeds energy code requirements by at least 15 percent, but not necessarily at a first cost premium beyond a 7.5-year return on investment on energy conservation measures.

13.2 DESIGN CRITERIA

Energy Analysis

An energy analysis of building characteristics, the mechanical and electrical components, and all other related energy consumption elements must be performed for each project design submission level in accordance with the energy code.

The analysis of energy-conserving designs shall include all relevant facets of the building envelope; lighting energy input, domestic water heating, efficient use of local ambient weather conditions, building zoning, efficient part load performance of all major HVACR equipment and the ability of building automation equipment to automatically adjust for building partial occupancies, optimized start-stop times, and systems resets. The energy analysis shall utilize approved public domain programs in accordance with the energy code.

Design Studies

When comparative analysis is required, at a minimum, the following systems shall be presented as alternatives:

- Chilled water and heating water based systems when the total connected design load exceeds 100 tons. The HVACR designer is required to first consider and rule out using chilled water concepts before specifying any high-efficiency Direct Expansion (DX) Refrigeration equipment.
- Air handlers with air-cooled package chillers are preferable to field-piped (spilt system) direct expansion (DX) systems. Field-piped DX evaporators with condensing units is not allowed, unless in the schematic design phase, a case can be made to prove that the chilled water system application does not have a favorable life cycle cost or if it can be demonstrated that the application requires a DX approach.
- Field-piped DX systems: if used, the engineer of record shall develop and show details of the field-piped refrigeration system layout. Include cost for all field piping in the price the equipment, accessories and specialties needed to insure proper operation; provide compressor protection.

Winter Cooling Criteria Limitations

When cooling coil freezing is a risk, the use of freeze-point depressants in chilled water systems is preferred unless all piping is within mechanical spaces. Arrange non-freeze type steam or heating water coils for positive gravity condensate or water drainage. Annual draining of coils is not an acceptable design solution.

- Winter cooling without refrigeration may be either 100 percent outside air (airside economizer) or condenser water based free cooling.
- With airside economizers, barometric relief is the preferred means of relieving building pressurization. Where return air fans are used, avoid the over-pressurization of the building. Acceptance and commissioning testing shall, among other aspects of HVACR operation, require proof of system operation with 100 percent outside air with no adverse effect on building pressurization.
- When outdoor air is used for winter cooling, an enthalpy-based integrated economizer control shall be used when feasible.
- Avoid elevated chilled water temperatures during the waterside economizer system operations to prevent humidity build-up in the space.
- Water-side economizer design shall maintain the chilled water supply at design temperature, consider a design that incorporates the free cooling heating exchanger in series with the chiller.
- Assure that the system can revert to chiller operation within five minutes, without waiting for cooling tower loop temperature (condenser water) to rise within a predetermined time period.
- Regardless of the presence of a waterside economizer, the design shall incorporate provisions for purging the building with high volumes of outside air while the construction materials are out-gas-

sing.

Heating Systems Criteria Limitations

Hot water is the preferred space-heating medium. The application of electric resistance heating is discouraged unless a case for it can be made in the schematic design phase. Heating systems with steam terminal units in occupied spaces will not be allowed.

Return Air Provisions

Return air from each contiguous area shall be ducted back to the system to ensure that return air is not exposed to combustible and flammable materials in the ceiling plenum and to prevent settlement of dust in the ceiling plenum. In mechanical rooms, all return and outside air shall be ducted. The use of the mechanical room as a plenum shall not be permitted.

Ventilation Methods

Ventilation Air and Indoor Air Quality Criteria: The California Energy Code (Title 24, part 6) and ASHRAE Standard 62n shall be the basis for quantification of minimum indoor ventilation rates. The indoor population density and the building code occupancy classification shall be defined in the project program document. Reasonable assumptions are encouraged in determining the population and ventilation air quantity, but the assumptions must be documented and understood. Unless the specific application or the applicable Building and Energy Code mandate higher ventilation air quantities, the HVACR designer shall pursue a reasonable first cost, energy-efficient HVACR design. Where aspects of the Energy Code and air quality are in conflict, air quality shall take precedence.

The design shall incorporate Demand Controlled Ventilation (DCV) utilizing Carbon Dioxide (CO2) sensors where appropriate, to minimize cooling, dehumidification and heating of outside ventilation air where required by ASHRAE Standard 62n and the Energy Code.

When a building is new, volatile compounds (VOC) may be released in large quantities from materials, such as adhesives, vinyl, and carpets. An outside air purge cycle shall be provided by the air-handling system to enable the removal of VOC build-ups prior to occupancy. The design shall provide continuous mechanical means and methods to maintain and or control the availability of acceptable, minimum, outside ventilation air rates prescribed by the Energy Code and ASHRAE Standard 62n. In areas where exhaust systems are used or an indoor air quality contaminant source is located, a negative pressure zone shall be maintained relative to surrounding spaces.

The intent is to centrally cool, dehumidify, heat, and filter the mandated amount of ventilation or outdoor air, then deliver the ventilation air at room temperature to all occupied spaces, while accomplishing space temperature control.

System Schemes:

- Fan coil units (four-pipe) as a means of space temperature control may be used. The use of fan-coil units to introduce and condition outside ventilation air is acceptable on a project specific condition.
- For new construction with significant latent loads and with ceiling distribution, use a ducted overhead variable air volume (VAV) air distribution system with VAV shutoff boxes for cooling, hot water terminal heating, and hot water fin-tube systems for heating.
- For new construction with ducted overhead ceiling distribution, use a VAV air distribution system with fan-powered VAV boxes for cooling and with hot water terminal heating.
- For new construction with low occupancy loads and other spaces with low latent loads, use a VAV air distribution system, for cooling, supplemented with two-pipe, above floor perimeter hot water fin-tube systems for heating.
- A ducted VAV system with VAV boxes and hot water terminal heating
- A ducted VAV system with fan-powered VAV boxes and heat water terminal heating

Special System Provisions:

- Special areas such as atriums and localized public lobby transitions areas shall have a dedicated air-handling unit with individual controls to condition these spaces as required.
- Air-handling units with a capacity over 1,180 LPS (2,500 CFM) and system with mechanical cooling capacity over 75,000 btus/hour shall have an economizer cycle in accordance to the Energy

code.

- Systems dedicated to serving only unoccupied spaces with intermittent operation, such as elevator machine rooms, telephone equipment rooms and similar spaces shall be exempt from the requirement of an economizer cycle. Waterside economizer system shall be employed where airside economizer is not practical or feasible.

HVACR Design Criteria

Compliance with the latest versions of California Title 24 Energy Code and ASHRAE Standard 62n shall be required for the project when designing the building envelope, mechanical and electrical systems. Outdoor air design conditions shall be based ASHRAE publications SPCDX: Climatic Data for region X, Arizona, California, Hawaii and Nevada – 1982. Winter design conditions shall be no lower than the listed winter median of extremes column. The HVAC load calculations shall be based on the 0.5 percent column of the listed design wet bulb temperature.

Indoor Design Criteria:

Summer: 23.3 C (74 F degrees dry bulb +/-2 degrees, operating range of 72 - 76 F)

Winter: 19.9 C (68 F degrees dry bulb +/-2 degrees, operating range of 66 - 70 F)

Relative Humidity Controls Criteria

Summer: Unless noted to the contrary in the project program, inside relative humidity is not to be directly controlled. Dehumidification is a byproduct of the cooling process. However, the cooling equipment and systems shall be selected and sized to produce 45 percent Relative Humidity + /- 10 percent in the conditioned space when the design outside conditions prevails and other design parameters are fulfilled.

Winter: The criteria standard is to not add moisture to the air stream. When the program document indicates that humidification in the winter is required, the humidification equipment shall be sized to the facility envelope's ability to accommodate elevated levels of the interior air dew point. Conditions that result in condensation on inside surfaces, visible or concealed must be avoided. Avoid microbial growth on interior surfaces.

Building Pressurization Criteria: To keep dry air flowing through building interiors, sequence operations of systems to assure continuous positive pressure with respect to the outdoor environment.

Air Intake and Exhaust: The placement and location of outside air intakes is critical to the safety of the occupants and must be in compliance with ASHRAE Standard 62n and the building security requirements. The intake of the facility shall minimize the established of entrainment flows of exhaust air into the air intakes per ASHRAE Standard B62n. The outside air intake louvers shall consist of a drainable stationary storm louver in accordance to AMCA 500L certification rating.

Internal Heat Gains

Occupancy Levels Gains: For office spaces, the average density of the floor area of a building is one person per 120 usable square feet. The workstations occupancy load can be as dense as one person per 75 usable square feet. Block loads and room loads shall be calculated accordingly. Sensible and latent loads per person shall be based on the latest edition the ASHRAE Handbook of Fundamentals. For courtrooms, auditoriums, assembly and other high occupancy spaces with fixed seating, occupancy loads shall be based on the number of fixed seats available.

Equipment Densities Gains: Internal heat gains from all appliances (electrical, gas, or steam) shall be taken into account. When available, manufacturer-provided heat gain and usage schedules shall be utilized to determine the block and peak cooling loads. Typical rate of heat gain from selected office equipment shall be based on the latest edition of the ASHRAE Handbook of Fundamentals.

The cooling load estimated for the connected electrical load shall be based on the electrical load analysis and the estimated receptacle demand loads.

Zoning Criteria

Independent zones shall be provided for spaces such as courtrooms, chambers suites, jury deliberation rooms, entrance lobbies, atriums, child waiting areas and their respective ancillary areas. Interior control zones shall not exceed 1,500 square feet per zone for open office areas, or a maximum of four offices per zone for closed office areas. Perimeter zones shall not exceed 400 square feet. Corner offices shall be

considered a dedicated zone. Perimeter zones shall be no more than 20 feet from an outside wall along a common exposure.

Single air handling units shall not serve multiple floors or scattered building loads. Multiple air handling units or floor-by-floor systems shall be considered as base line.

Sequence zone controls to prevent simultaneous heating and cooling for constant volume systems and VAV reheat systems. The cooling supply shall minimized prior to applying terminal reheat. Supply air temperature reset control shall be utilized to extend economizer operations and to reduce the magnitude of reheating, re-cooling or mixing of supply air streams.

Arrangement of Mechanical Spaces

Service Access: Distribution system access doors or panels shall be provided in ventilation equipment, ductwork, and plenums for on-site inspection and cleaning. Equipment access doors or panels shall be readily operable and sized to allow full access. Large central equipment shall be situated to facilitate replacement. Provide access for the replacement of major equipment over the life of the building, and ensure that provisions are made to remove and replace, without damage to the structure, the largest and heaviest component that cannot be further broken down. Provide adequate access to chillers, boilers, heat exchangers, cooling towers, reheat coils, VAV boxes, pumps, motors, water heaters and all devices with maintenance service requirements. The main mechanical equipment rooms generally shall have clear ceiling heights of not less than 12 feet. Provide walkways for all equipment that cannot be maintained from floor level. Where maintenance requires the lifting of heavy parts 45 kg (100 pounds) or more, provide and install hoists and hatchways. Configure mechanical rooms with clear circulation aisles and adequate access to all equipment. The arrangement shall consider the future removal and replacement of all equipment. The mechanical rooms shall have adequate doorways or areaways and staging areas to permit the replacement and removal of equipment without the need to demolish walls or relocate other equipment. The design shall provide sufficient space, per manufacturer's recommendations, for maintenance and removal of coils, filters, motors, and similar devices.

- Chillers shall be placed to permit pulling of tubes from all units. The clearance shall equal the length of the tubes plus two feet.
- Air-handling units require a minimum clearance of 2 feet-6 inches on all sides, except the side where filters and coils are accessed. The clearance on that side shall equal the length of the coils plus two feet.

Roof Mounted Equipment: No mechanical equipment except for air handlers, cooling towers, air-cooled chillers, evaporative condensers and exhaust fans shall be permitted on the roof of the building. The equipment shall be skid mounted on structural base rails supported off the finished roof. The access to roof-mounted equipment shall have permanent code compliance access to roof mounted equipment.

Housekeeping Pads: The housekeeping pads shall be at least six inches wider on all sides than the equipment they support and shall be a minimum of height of 3-1/2 inches above the finished floor. The pad shall be of adequate height to trap and drain condensate from heat transfer coils to the condensate drain.

Mechanical Requirements for Special Spaces

Courtrooms and their respective ancillary areas shall constitute a primary zone.

Individual chambers suites shall be independently controlled and zoned to enable off hours temperature control.

Auditoriums and Assembly Rooms shall have air-handling units equipped with economizer cycle.

Public lobby transitional workstation areas shall be provided with sufficient localized supplemental cooling, heating and ventilation to maintain space temperatures of 19.9 – 23.3 C (68 - 74F) with intermittent drop by 2.8 C (- 5) during winter and raise of + 5.6C (+10) during summer.

Holding Areas: The HVAC system shall be designed for continuous operation and shall be independently controlled and zoned. All ductwork and air circulation openings penetrating the secure area envelope, including prisoner circulation areas, shall be designed for maximum security, with security bars and tamper resistant diffusers with openings no greater than 3/16 inches in diameter. Holding areas shall be negatively

pressurized with regard to adjacent spaces and exhausted directly outdoors.

Mail Rooms: If required by the threat assessment, mailroom HVAC systems shall be designed to minimize worker inhalation exposure to the potentially hazardous, aerosolized, particles, such as inhalation of weapon grade Anthrax particles. The mailroom shall have segregated exhaust under negative pressure and be maintained under a negative pressure condition relative to surrounding spaces. The design shall provide one of the following alternatives:

- A proven and dedicated packaged air-handling system capable of 99.97 percent HEPA filtration for room exhaust streams. The design shall be include a complete engineered control and monitoring system that includes an integrated control with local alarm notification system.
- A proven and dedicated packaged, pre-manufacturer; Bio-containment, mail sorting workstation with integrated 99.97 percent HEPA filtration, exhaust fan monitoring, control and local alarm notification systems.

Mechanical rooms shall be mechanically ventilated to maintain room space conditions as indicated in ASHRAE 62n Standard, Energy Code and ASHRAE 15 Standards. Water lines shall not be located directly above motor control centers or disconnect switches and shall comply with code requirements. The mechanical rooms shall have sloped floors with floor drains in proximity to the equipment they serve to reduce water streaks or drain lines extending into aisles. The mechanical equipment rooms containing equipment that use refrigerants must be designed in accordance with the requirements of ASHRAE Standard 15: Safety Code for Mechanical Refrigeration.

Chiller Equipment Rooms shall be constructed and equipped to comply with ASHRAE Standard 15: Safety Code for Mechanical Refrigeration. A standalone DDC type chiller plant control system shall be provided in the chiller room, interfaced with the (DDC) HVAC Building Control System. The chiller room shall be ventilated per ASHRAE Standard 15. The dedicated chiller staging control systems, motor control center, variable frequency drives (VFDs) or disconnects shall be capable of connecting in the room and be operative with the (DDC) HVAC building control system.

Electrical and Communication Equipment Rooms: No water lines are permitted in or overhead in electrical and communication rooms, except for fire sprinkler piping or chilled water and condenser water piping serving the dedicated cooling serving the electric and communication room. Avoid locating fire sprinkler pipes, chilled or condenser water pipes directly above any electrical and communication equipment. The electrical and communication room fire sprinkler head temperature selection shall be at least 200 F or higher.

Elevator Machine Rooms: A cooling or ventilating system must be provided to maintain elevator machine room temperature and humidity conditions in accordance to the elevator code and elevator equipment requirements. If hoist way venting is required by code and if the building is a high-rise, provide an automatic damper which is controlled by the smoke detector in the hoist way. Pressurize the machine room for the high-rise building per code.

Emergency Generator Rooms: The environmental systems shall meet the requirements of NFPA Standard 110 (Emergency and Standby Power Systems) and meet the combustion air requirements of the equipment. Rooms must be ventilated sufficiently to remove heat gain from equipment operation. The air supply and exhaust shall be located so air does not short circuit. Generator exhaust shall be carried up to roof level. The exhaust flue shall be in compliance with the mechanical code and the generator manufacturer's installation recommendations. Horizontal exhaust through the building wall shall be avoided.

UPS Designated Battery Rooms: The battery room must be ventilated and exhausted directly to the outdoors at a rate calculated to be in compliance with mechanical and building code requirements and manufacturer's recommendations. The design shall be coordinated with electrical design specifications to include HVAC support equipment in the UPS extended servicing agreements.

Loading Docks and Sally Ports: The entrances and exits at loading docks and service entrances shall be provided with a positive means to reduce infiltration and collection of outside debris. Loading docks must be maintained at negative pressure relative to the rest of the building. Sally Ports shall be ventilated to prevent build-up of engine exhaust fumes and transferring of fumes into the building. Sallyports

shall be equipped with ventilation fans controlled by carbon monoxide detection and controlled by carbon monoxide detection and control system to automatically purge the sallyport when unsafe levels of carbon monoxide are detected.

24-Hour Spaces: All areas designated as requiring 24-hour operations shall be provided with a dedicated and independent HVACR system. All control rooms housing the computer-based control systems such as for HVAC building control systems, fire alarm control and monitoring systems, security control and monitoring systems, building energy management systems and similar systems shall be provided with a dedicated, high reliability, HVAC system to maintain proper temperature, humidity and ventilation requirements at all times. All twenty-four hour systems shall have dedicated central chillers, cooling towers, boilers, and associated pumping systems. Systems that have a capacity of up to 100 tons shall be configured with air-cooled chillers when feasible.

Toilets: The toilet rooms shall be served by dedicated exhaust systems to maintain negative pressure in the rooms relative to the surrounding spaces. Provide adequate air changes per the code requirements.

Janitor and Housekeeping Closets: The janitor and housekeeping closets shall be served by a dedicated exhaust system to maintain negative pressure in the rooms relative to the surrounding spaces. Provide adequate air changes per the code requirements. If necessary both rooms may be served by a common exhaust system.

Copy Areas: All copy areas shall have a localized exhaust adjacent to high volume reproduction machinery and shall be negative in pressure to the surrounding areas.

High Occupancy Areas: High occupancy areas such as conference rooms and jury assembly rooms which are served by dedicated ventilation and or air-handling systems, shall incorporate CO2 demand controlled ventilation (DCV) in accordance with the energy code to minimize energy consumption, while maintaining appropriate levels of ventilation and pressure relationships between spaces and the outdoors. The DCV system terminal devices shall be located outside of the designated occupancies for maintenance, and shall provide appropriate operation of the ventilation system. The DCV sensors shall be located within the designated occupancies at the appropriate breathing zone height.

For Security Equipment Closet requirements see Chapter 4 (Courthouse Security). For Telecommunication Equipment Rooms see Chapter 16 (Telecommunications and Audiovisuals Design Criteria).

Equipment Redundancy, Spare Capacity and Back-up Power

Redundancy is mandated only in the case of critical systems and equipment identified as critical in the program document; however, the design shall provide for redundancy in the following items of mechanical equipment, if such equipment is a part of the project design and if the need for redundancy has not been expressly waived by the program document. Equipment shall be sized at half design capacity and used in multiples of two. Allowance for load growth beyond that specified below shall be stated in the program requirements.

- Package sump pumps (storm water): Incorporate duplex pumping with automatic alternators. A single pump shall handle design flows with 40 percent run time. This equipment shall be powered from the emergency generator if an emergency generator is part of the project. It is not the intent of this provision to create a requirement for an emergency generator. The equipment covered by this provision does not refer to residential-type submersible pumps, powered from 120 VAC receptacles.
- Condensate (steam) return units: Incorporate duplex pumps with automatic alternators. A single pump shall handle design flows with 40 percent run time. This equipment shall be powered from the emergency generator, if an emergency generator is part of the project.
- Sewage Ejectors: Incorporate duplex pumping with automatic alternators. A single pump shall handle design flows with 40 percent run time. Sewage sump and pumps that serve the holding cell areas shall be of the chopper variety pump, which can chop clothes and other debris dumped by the detainees. This equipment shall be powered from the emergency generator, if an emergency generator is part of the project.

- Submersible sump pumps: There is no requirement for redundant pumps. However, a high water and or oil level alarm shall be required, connected to the HVAC building control system or local alarm, and the submersible pump shall be powered from the emergency generator, if an emergency generator is part of the project. The sump pump discharge shall be plumbed in accordance to the codes and environmental regulations and practices of the authority having jurisdiction. Submersible pumps shall not be used in pits where exposed to temperatures above100 degrees F.

- Chilled water pumps: In single chiller applications, a second, full sized pump/motor assembly shall be included to serve as standby pump. The second pump shall be designed with manual or automatic isolation valves for starting after a failure of the main pump. It is permissible to use the spare pump as a standby pump for an associated single condenser water pump.

- Primary chilled water pumps: In multiple chilled water chillers application with dedicated primary chilled water pump/motor assemblies, a standby shall be specified.

- Secondary chilled water pumps: Where secondary chilled water pumps used, it shall consist of the main pump and a standby pump, each shall be driven by a dedicated Variable Frequency Drives (VFDs). Both the main and standby pumps shall each be sized to handle 100 percent of the required system flow requirements. The standby pump and the main pump shall be alternated on a schedule to impact uniform wear on each pump.

- Condenser water pumps: In single chiller or tower applications, a second full size condenser water pump shall be provided. It is permissible to use the spare condenser water pump as a standby pump for a single chilled water pump. In multiple chiller or pump applications, with a dedicated condenser water pump in each condenser water circuit, one additional standby pump and motor shall be specified.

- Primary hot water pumps: In single boiler applications, a second, full sized pump/motor assembly shall be provided. The second pump shall be designed for manual valving in and starting after a failure of the main pump. In multiple boiler or dedicated hot water pump applications (such as in primary/secondary pumping), provide one additional primary hot water pump with a dedicated VFD and motor.

- Secondary hot water pumps: Where used, secondary hot water pump shall be VFD controlled. One additional pump shall be provided, with a dedicated VFD and motor.

- Control air compressors: A single tank is acceptable. The design shall incorporate duplex air compressors or motors with automatic alternator. The design shall be predicated on one third run time for one compressor, with the second compressor designed as a full standby. There is no requirement for redundancy in the refrigerated air dryer or oil filter system.

13.3 HVACR SYSTEMS COMPONENTS

Ventilation Units System

All perimeter ventilation units shall be a self-contained DX package units, water–source heat pump, variable volume box with reheat coil, air-handling unit with fan section having variable speed drive, or chilled water cooling coil and hot water heating coil and supply air filtration. The ventilation units shall be capable of providing 100 percent outside air. The ventilation unit shall have self-contained microprocessor controls capable of connecting to and interoperating with a native BACnet or Lonmark Direct Digital Control (DDC) HVAC building control system. It shall also be equipped with dampers and or VFD to set the design airflow through the unit. The DDC controller shall measure and display the amount of air flowing through the unit continuously basis locally and remotely at the central operator workstations. The control system shall be designed to use the available energy efficiently and to assist in troubleshooting the malfunction addressable and non-addressable controlled devices.

Fan Coil Chilled Water Systems

If perimeter spaces require individual fan coil units, specify a four-pipe fan coil unit with cooling coil, heating coil, 35 percent efficiency filters, internal condensate drain, and overflow drain. Units shall have self-contained microprocessor controls and shall be capable of connecting to and interoperating with a BACnet or Lonmark Direct Digital Control HVAC building control system. Fan coil units shall

be capable of operating with unit mounted or remote mounted temperature sensor.

Fin Tube Heating System

When fin-tube radiation is used, the design shall incorporate individual zone thermostatic control capable of connecting to a self-contained microprocessor that can interface with a Native BACnet or Lonmark Direct Digital Control HVAC building control system.

Variable Volume System with Reheat Boxes

A variable air volume system with hot water reheats shall be used for perimeter zone applications. VAV shutoff boxes may be used with the perimeter air distribution systems in order to eliminate the need for reheat. The air-handling unit and associated VAV boxes shall have self-contained microprocessor controls capable of connecting to and interoperating with a native BACnet or Lonmark Direct Digital Control HVAC building control system.

Variable Volume System with Fan-Powered Boxes

A variable air volume system with fan-powered VAV boxes may be used for both perimeter and interior zone applications. The air-handling unit and associated VAV boxes shall have self-contained microprocessor controls capable of connecting to and interoperating with a BACnet or Lonmark Direct Digital Control HVAC building control system. The fan powered boxes shall be equipped with a ducted return, featuring a filter/filter rack assembly and covered on all external exposed sides with two-inches of insulation. The return plenum box shall be a minimum of 610 mm (24 inches) in length and shall be double wall with insulation in-between or contain at least one elbow where space allows. Fan-powered boxes may have hot water heating coils used for maintaining temperature conditions in the space under partial load conditions. Fan powered boxes located on the perimeter zones and on the top floor of the building shall contain hot water coils for heating.

Heat Pump System

A console perimeter heat pump system may be considered for the perimeter zone. For the interior zone either a packaged heat pump variable volume system or a central station air-handling unit with cooling-heating coil with VAV boxes shall be considered. Condenser water loop temperatures shall be maintained between 15°C (60°F) and 27°C (80°F) year round, either by injecting heat from a gas fired, modular boiler if the temperature drops below 15°C (60°F) or by rejecting the heat through a cooling tower if the temperature of the loop rises above 35°C (95°F) dry bulb. Outside air shall be ducted to the return plenum section of the heat pump unit. Heat pumps shall be provided with filter/filter rack assemblies upstream of the return plenum section of the air-handling unit.

Central Station Air-Handling Units (AHUs)

An air-handling unit shall be sized to not exceed 23,600 l/s (50,000 cfm). Smaller units are encouraged to facilitate flexible zone control, particularly for spaces that involve off-hour or high-load operating conditions. To the extent possible, 'plug-n-play' AHU configurations shall be considered, facilitating future adaptations to space-load changes.

Psychometric analyses (complete with chart diagrams) shall be prepared for each air-handling unit application, characterizing full and part load operating conditions. Air-handling unit and coil designs shall assure that conditioned space temperatures and humidity levels are within an acceptable range, per programmed requirements, and ASHRAE Standards 55 and 62n.

The dedicated central station air handler unit shall have self-contained microprocessor controls capable of connecting to and interoperating with a Native BACnet or Lonmark Direct Digital Control HVAC building control system. It shall be equipped with automatic control dampers and or VFD to set the design airflow through the unit. The AHU shall have an analog and or digital display, which measures and displays the amount of air flowing through the unit continuously locally and at the HVAC building control system remotely. The control system shall be designed to use available energy efficiently and to assist in trouble shooting the malfunction conditions of numerous addressable and non-addressable controlled devices.

Depending on sensible heat ratio characteristics, effective moisture control may require cooling coil air discharge dew point temperatures as low as 10°C (50°F). As required, provide face-by-pass or heat recovery features to re-heat cooling coil discharge

temperatures for acceptable space entry. Provide a direct form of re-heat and/or humidification only if space conditions require tight environmental control, or if recurring periods of unacceptable humidity levels would otherwise result.

AHU Casing Construction

Refer to Table 13.1 (AHU Matrix) for further design details

Supply Fans

The air handlers shall be equipped with direct drive plenum type airfoil fan with modular VFD drives for all HVAC supply fan systems. All fans shall bear the AMCA seal and performance shall be based on tests made in accordance with AMCA Standard 210. The fans shall be selected on the based of required horsepower as well as sound power level ratings at full load and at part load conditions. Fan motors shall be sized so they do not run at overload anywhere on their operating curve. Fan operating characteristics must be checked for the entire range of flow conditions. Supply fan motors shall be selected for a 1.15 service factor. Thrust arresters shall be designed for horizontal discharge fans operating at high static pressure.

Return and Relief Air Fans

All fans shall bear the AMCA seal and performance shall be based on tests made in accordance with AMCA Standard 210. Fans shall be selected on the basis of required horsepower as well as sound power level ratings at full load and or at part load conditions. The fan motors shall be sized so they do not run at overload anywhere on their operating curve. Fan operating characteristics must be checked for the entire range of flow conditions. Exhaust fan motors shall be selected for a service factor of 1.3. Thrust arresters shall be designed for horizontal and vertical discharge thrust of the fan operating at 1.2 times the total design pressure.

Coiling and Heating Coils

Each individual finned tube coils shall generally be between four and eight rows with maximum of 2.4 mm space between fins (10 fins per inch) to ensure that the coils can be effectively and efficiently cleaned. The dehumidifying coils shall be selected for no more than negligible water droplet carryover beyond the drain pan at design conditions. All hot water heating and chilled water-cooling coils shall be copper tube and copper finned materials. Equipment and other obstructions in the air stream shall be located sufficiently downstream of the coil so that it will not come in contact with the water droplet carryover. Cooling coils shall be selected at or below 2.35 m/s face velocity (475 fpm) to minimize moisture carryover. Heating coils shall be selected at or below 3.8 m/s face velocity (750 fpm).

Drains and Drain Pans

The condensate drain pans shall be made of 304 stainless steel, insulated and adequately double sloped with no standing water and trapped to assure proper drainage. Drains in draw-through configurations shall have traps with a depth and height differential between inlet and outlet equal to the design static pressure plus one inch minimum.

Filter Sections

A filtration section shall be provided in each air handling system. Air-handling unit pre-filter and final filters shall be disposable and totally incineratable. The filter media shall contain non-electrostatic charged media.

- Pre-Filter Section: Pocket filter, 45-50 percent efficiency, low pressure drop filter, capable of filtering down to 3.0 microns per ASHRAE Standard 52.2, MERV 10 rating
- Final Filter Section: Pocket filter modules, 85 percent efficiency, low pressure drop filter capable of filtering down to 1.0 microns per ASHRAE Standard 52.2, MERV 13 rating

If the project threat assessment determines that a credible bio-aerosol threat exists, a germicidal filtration technology system shall be provided downstream of the pre-filter and fan section.

- Pre-Filter Section: Pocket filter, 45-50 percent efficiency, low pressure drop filter, capable of filtering down to 3.0 microns per ASHRAE Standard 52.2, MERV 10 rating
- Indoor Air Quality and Bio Hazard Reduction Section: A Germicidal, high efficiency, high voltage charged, low pressure drop, grid modules and power supplies.
- Final Filter Section: Pocket filter modules, 95

percent efficiency, low pressure drop filter capable of filtering down to 1.0 microns per ASHRAE Standard 52.2, MERV 15 rating

The final filter racks shall be designed to minimize the bypass of air around the filter modules with a maximum allowable bypass leakage of 0.5 percent at six inches of static pressure. Refer to Table 13.1 (AHU Matrix) for further design details. The filters shall be sized at 2.5 m/s (475 FPM) maximum face velocity. The filter media shall be fabricated from non-electrostatic charge filter media materials. The filter media shall be fabricated to minimize fibrous shedding that does not exceed levels prescribed by ASHRAE Standard 52.2. The filter housing and all air-handling components downstream shall not be internally lined with foil backed fibrous insulation. Double-wall construction with internally insulated sheet metal casing is required.

The design shall use published recommended filter change-out pressure drop and the initial clean filter rating to determining fan pressure requirements. Differential pressure gauges and sensors shall be placed across each filter bank to allow quick and accurate assessment of filter dust loading as reflected by air-pressure loss through the filter and sensors shall be connected to building automation system.

Air Handler Access Doors

Low leakage, double wall, internal insulated, gasketed access doors with windows and capped testing ports shall be provided at air handling units upstream and downstream of each coil and each filter section, and adjacent to each drain pan and fan section. Access doors shall be of sufficient size to allow service personnel to enter the unit to inspect and service all portions of the equipment components.

Air Distribution Access Doors

The air distribution ductwork shall have a low leakage, double wall, internal insulated, gasketed access door at 40-foot intervals along the air distribution ductwork system to allow for inspection and cleaning of the entire system.

Air Distribution Identification Labeling

The air distribution system and associated system equipment shall be identified with markers in accordance to ANSI A13.1. The labels shall not be less than two-inch high letters for ductwork, not less than .75-inch high letters for access doors and not less than one-inch high for equipment. The ductwork system labels shall be installed at 30-foot intervals.

Plenum Boxes

The air-handling units shall be provided with a plenum box where relief air is discharged from the air-handling unit. Plenum boxes may also be used on the return side of the unit in lieu of a mixing box.

Mixing Boxes

The air-handling units shall be provided with mixing boxes where relief air is discharged from the air-handling unit. Mixing boxes may also be used on the return side of the unit in lieu of a plenum box. Airflow control dampers shall be mounted within the mixing box or on the ductwork connecting to the mixing box.

VAV Terminal Boxes

All VAV terminal boxes shall be certified under the ARI Standard 880 Certification Program and shall carry the ARI Seal. The manufacturer shall provide a five-year warrantee on the VAV Terminal boxes. If fan-powered, the terminals shall be designed, built, and tested as a single unit including motor and fan assembly, primary air damper assembly, and any accessories. The VAV terminal boxes selected shall be pressure-independent type units. The terminal units shall have BACnet or Lonmark self-contained controls.

Fan-Powered VAV Terminals Boxes

All fan-powered terminals shall be quiet-type, utilizing speed control to allow for continuous fan speed adjustment from maximum to minimum as a means of setting the fan airflow. When possible, specify ECM motor driven fans. All terminals shall be provided with factory-mounted direct digital controls compatible and suitable for operation with the HVACR control system.

Air Delivery Devices

All terminal ceiling diffusers or booted-plenum slots shall be specifically designed for VAV air distribution. Booted plenum slots shall not exceed four feet in length unless more than one source of supply is provided. “Dumping” action at reduced air volume and sound power levels at maximum m3/s (cfm) delivery shall be minimized. For all VAV systems, the diffuser

spacing selection shall not be based on the maximum or design air volumes but rather on the air volume range where the system is expected to operate most of the time. The design shall consider the expected variation in range in the outlet air volume to ensure the air diffusion performance index (ADPI) values remain above a specified minimum. The design shall provide ventilation rates required by ASHRAE Standard 62n and the energy code incorporating selected diffusers that effectively mix the total air in the room with the supplied conditioned air, which is assumed to contain adequate ventilation air.

Electrical Motors

All motors shall have premium efficiency as per ASHRAE 90.1 and the energy code. All 0.5 HP and larger shall incorporate poly-phase configuration. All motors 0.5 HP and smaller shall be single phase. For motors operated with variable speed drives, provide inverter-duty motors with Class-F insulation per NEC and NFPA.

Boilers

All boilers for hydronic hot water heating applications shall be low pressure, with a working pressure and maximum temperature limitation stated, and shall be installed in a dedicated mechanical room with all provisions made for breeching, flue stack and combustion air. For installations where the ASHRAE Winter design is 0.5 C (33 F) and below, a minimum of three equally sized units shall be provided. Each of the three units shall have equal capacities such that the combined capacity of the three boilers shall satisfy 120 percent of the total peak load of heating and humidification requirements. For installations in where the ASHRAE Winter design 1.1 C (34 F) and above, a minimum of two equally sized units at 55 percent of the peak capacity (each) shall be provided. The units shall be packaged type with all components including boiler circulation pumps, gas trains, burners, combustion blowers and control, pre-assembled and tested in accordance with IRI Standards. All controls and ASME relief valves to limit pressure and temperature must be specified separately. All burner control shall be return water temperature actuated and control sequences, such as modulating burner control and outside air reset, shall be utilized to maximum efficiency and performance. Multiple closet type condensing boilers shall be utilized, if possible.

All boilers shall have self-contained microprocessor controls capable of connecting to and interoperating with a Native BACnet or Lomark Direct Digital Control HVAC control system.

All boilers shall have a minimum efficiency of 81 percent as per ASHRAE 90.1. Individual boilers with ratings higher than 29 MW (100 million Btu/hour) or boiler plants with ratings higher than 75 MW (250 million Btu/hour) are subject to review by the Environmental Protection Agency.

All boilers shall be piped to a common heating water header with provisions to sequence boilers on-line to match the load requirements. All units shall have adequate valving to provide isolation of off-line units without interruption of service. All required auxiliaries for the boiler systems shall be provided with expansion tanks, heat exchangers, water treatment and air separators.

All boiler gas trains shall be UL Listed and in accordance with International Risk Insurance (IRI) Standards. The gas valve actuators specified shall not contain NaK (sodium-potassium) products as they are hazardous to maintenance personnel.

Venting

The products of combustion from fuel-fired appliances and equipment shall be terminated to the outside of the building through the use of breeching, vent, stack and chimney systems. Breeching connecting fuel-fired equipment to vents, stacks and chimneys shall be horizontal and shall comply with NFPA 54 Standards. All vents, stacks and chimneys shall be vertical and shall comply with NFPA 54 and 211 Standards. Breeching, vent, stack, and chimney systems may operate under negative, neutral, or positive pressure and shall be designed relative to the flue gas temperature and dew point, length and configuration of the system, and the value of the insulation techniques applied to the vent. All venting materials may be factory fabricated and assembled in the field and may be double or single wall systems, depending on the distance from adjacent combustible or noncombustible materials. Material types, ratings and distances to adjacent building materials shall comply with NFPA 54 and 211 Standards.

Heat Exchangers

The project shall apply steam-to-water heating in situations where district steam is supplied and a hot water

space heating and domestic hot water heating system have been selected. The use of double-wall heat exchangers shall be applied for all domestic hot water heating applications. Plate heat exchangers shall be used for waterside economizer applications.

Chillers

All chillers shall be specified in accordance with the latest Air-conditioning and Refrigeration Institute (ARI) ratings procedures and latest edition of the Energy Code and ASHRAE Standard 90.1. As a part of the life cycle cost analysis, the use of high-efficiency chillers with COP and IPLV ratings that exceed 6.4 (0.55 KW/ton) shall be analyzed. The feasibility of gas-engine driven chillers, thermal storage chillers, and absorption chillers shall be considered for demand shedding and thermal balancing of the total system. Native BACnet or Lonmark Microprocessor-based controls shall be used on all chillers. The control panel shall have self-diagnostic capability, integral safety control, graphic interface screen and set point display, such as run time, operating parameters, electrical low voltage and loss of phase protection, current and demand limiting, and output/input-COP [input/output (kW/ton)] information.

Chilled Water Machines Sizing Selection

When the peak-cooling load is 2640 KW (750 tons) or more, a minimum of three chilled water machines shall be provided. The three units shall have a combined capacity of 120 percent of the total peak-cooling load with load split percentages 40-40-40 or 50-50-20. If the peak-cooling load is less than 2640 KW (750 tons), a minimum of two equally sized machines at 60 percent of the peak capacity (each) shall be provided. All units shall have adequate valving to provide isolation of the off-line unit without interruption of service. All chillers shall be piped to a common chilled water header with provisions to sequence chillers on-line to match the load requirements. All required auxiliaries for the chiller systems shall be provided with expansion tanks, heat exchangers, water treatment and air separators. When multiple chillers are used, automatic shutoff valves shall be provided for each chiller. Chiller condenser piping shall be equipped with recirculation and bypass control valves to maintain incoming condenser water temperature within chiller manufacturer's minimum. Part load efficiency must be specified in accordance with ARI Standard 550/590 and Energy Code.

The design of refrigeration machines must comply with Clean Air Act amendment Title VI: Stratospheric Ozone Protection and Code of Federal Regulations (CFR) 40, Part 82: Protection of Stratospheric Ozone.

The uses of Chlorofluorocarbon (CFC) refrigerants are not permitted in new chillers. Acceptable non-CFC refrigerants are listed in EPA regulations implementing Section 612 (Significant New Alternatives Policy (SNAP) of the Clean Air Act, Title VI: Stratospheric Ozone Protection.

All refrigeration machines must be equipped with isolation valves, fittings and service apertures as appropriate for refrigerant recovery during servicing and repair, as required by Section 608 of the Clean Air Act, Title VI.

All chillers must also be easily accessible for internal inspections and cleaning.

Thermal Storage Equipment

A Thermal Storage Systems shall be considered in locations where the demand costs of electricity are greater than $15.00 per KW (demand costs for peak generation, transmission, and delivery costs), including prefabricated tanks with associated self contained glycol cooling chillers and monitor / control systems. The tank shall be insulated and the vendor shall guarantee its capacity and performance. Self-contained, fabricated thermal storage systems shall have self-contained Native BACnet or Lonmark microprocessor controls for charging and discharging the storage system and capable of being connected to a central (DDC) HVACR building control system.

Cooling Towers

The application of multiple cell cooling towers and isolated basins are required to facilitate operations, maintenance and redundancy of chilled water systems. The number of cells shall match the number of chillers. Supply piping shall be connected to a manifold to allow for any combination of equipment use. Multiple towers shall have equalization piping between cell basins. Equalization piping shall include isolation valves and automatic shutoff valves between each cell. Cooling towers shall have ladders and platforms for ease of inspections and replacement of components. Variable speed pumps and or fans for multiple cooling towers shall not operate below 25 percent of rated capacity.

The application of induced draft cooling towers with multiple-speed or variable-speed condenser fan controls shall be considered. Induced draft towers shall have a clear distance equal to the height of the tower on the air intake side(s) to keep the air velocity low. Consideration shall be given to piping arrangement and strainer or filter placement such that accumulated solids are readily removed from the system. Clean-outs for sediment removal and flushing from basin and piping shall be provided.

All forced draft towers shall have inlet screens. Forced draft towers shall have directional discharge plenums where required for space or directional considerations. Consideration shall be given to piping arrangement and strainer or filter placement such that accumulated solids are readily removed from the system. Clean-outs for sediment removal and flushing from the basin and piping shall be provided. The cooling tower's foundation, structural elements and connections shall be designed for a 44 m/s (100 MPH) wind design load.

The cooling tower basin and housing shall be constructed of 304 Stainless Steel. If the cooling tower is located on the building structure, vibration and sound isolation must be provided. Cooling towers shall be elevated to maintain required net positive suction head on condenser water pumps and to provide a 4-foot minimum clear space beneath the bottom of the lowest structural member, piping or sump, to allow re-roofing beneath the tower.

Special consideration shall be given to de-icing cooling tower fills if they are to operate in sub-freezing weather, such as chilled water systems designed with a waterside economizer. A manual shutdown for the fan shall be provided. If Cooling Towers operate intermittently during sub-freezing weather, provisions shall be made for draining all piping during periods of shutdown. For this purpose indoor drain down basins are preferred to heated wet basins at the cooling tower. Cooling Towers with waterside economizers and designed for year-round operation shall be equipped with basin heaters. Condenser water piping located above-grade and down to 3 feet below grade shall have heat tracing.

All cooling towers shall be provided with Native BACnet or Lonmark microprocessor controls, capable of connecting to central (DDC) HVAC building control systems.

Chilled Water, Hot Water, and Condenser Water Pumps

The pumps shall be of a centrifugal type and shall generally be selected to operate at 1750 RPM. Both partial load and full load must fall on the pump curve. The number of primary chilled water and condenser water pumps shall correspond to the number of chillers and a separate pump shall be designed for each condenser water circuit. Variable volume pumping systems shall be considered for all secondary-piping systems with pump horsepower greater than 10 KW (15 HP). The specified pump motors shall not overload throughout the entire range of the pump curve. Each pump system shall have a standby capability for chilled, hot water, and condenser water pumps. Each boiler cooling tower and chiller group pumps shall be arranged with piping, valves, and controls to allow each chiller-tower group to operate independently of the other chiller and cooling tower groups. The pumping systems shall have self-contained microprocessor controls capable of connecting to and interoperating with a Native BACnet or Lonmark direct digital control HVAC building control system.

13.4 HUMIDIFICATION AND WATER TREATMENT

Humidifiers and Direct Evaporative Coolers

The make-up water for direct evaporation humidifiers and direct evaporative coolers, or other water spray systems shall originate directly from a potable source that has equal or better water quality with respect to both chemical and microbial contaminants. Humidifiers shall be designed so that microbiocidal chemicals and water treatment additives are not emitted in ventilation air. All components of humidification equipment shall be stainless steel. Air washer systems are not permitted for cooling.

Humidification shall be limited to building areas requiring special conditions. Courthouse spaces shall not be humidified unless severe winter conditions are likely to cause indoor relative humidity to fall below 30 percent. Where humidification is necessary, atomized hot water, clean steam or ultrasound may be used and shall be generated by electronic or steam-to-steam generators. To avoid the potential for over saturation and condensation at low load, the total humidification load shall be divided between multiple, independently modulated units. Single-unit humidifiers are not acceptable. When steam is required during summer

seasons for humidification or sterilization, a separate clean steam generator shall be provided and sized for the seasonal load. Humidifiers shall be centered on the air stream to prevent stratification of the moist air. All associated equipment and piping shall be stainless steel. Humidification system shall have microprocessor controls and the capability to connect to HVAC Building Control System.

Water Treatment

A qualified specialist shall design the water treatment for all hydronic systems, including humidification systems. The design system shall address the three aspects of water treatment: biological growth, dissolved solids and scaling, and corrosion protection. The performance of the water treatment systems shall produce, as a minimum, the following characteristics; hardness: 0.00; iron content: 0.00; dissolved solids: 1,500 to 1,750 ppm; silica: 610 ppm or less; and a PH of 10 or above. The system shall operate with an injection pump transferring chemicals from solution tank(s) as required to maintain the conditions described. The chemical feed system shall have self-contained microprocessor controls capable of connecting to and interoperating with a direct digital control HVAC building control system. The methods used to treat the system make-up water shall have prior success in existing facilities on the same municipal water supply and follow the guidelines outlined in ASHRAE Applications Handbook.

13.5 HEATING SYSTEMS

Steam Heating Systems

The use of district steam heating, if available, shall be used if determined to be economical and reliable through a life cycle cost analysis. If steam is furnished to the building, such as under a district-heating plan, it shall be converted to hot water with a heat exchanger in the mechanical room near the entrance into the building. If steam heating is used, the designer shall investigate the use of district steam condensate for pre-heating of domestic hot water. Steam heating is not permitted inside the building other than conversion of steam-to-hot water in the mechanical room. The use of steam for HVAC applications shall be limited to the conversion of steam heat to hot water heat and for use in providing humidification. Steam shall not be used as a heating medium for distribution throughout a building to terminal units, air handling units, perimeter heating units, coils, or any other form of heat transfer where steam is converted to a source of heat for use in space comfort control or environmental temperature control.

The use of steam delivered from any source other than a clean steam generation system shall not be used for providing humidification. Steam delivered from a central plant, a district steam system, steam boilers, or any equipment where chemicals are delivered into the medium resulting in the final product of steam shall not be used for the purpose of providing humidification to the HVAC system or occupied spaces.

Hot Water Heating Systems

Low-temperature hot-water heating is the preferred system; 205 kPa (30 psi) working pressure and maximum temperature limitation of 93.3°C (200°F). Design and layout of hydronic heating systems shall follow the principles outlined in the latest edition of the ASHRAE Systems and Equipment Handbook. Supply temperatures and the corresponding temperature drops for space heating hot water systems must be set to best suit the equipment being served. Total system temperature drop shall not exceed 22°C (72°F). The temperature drop for terminal unit heating coils shall be 11°C (52°F). Design water velocity in piping shall not exceed 2.5 meters per second (8 feet per second) or design pressure friction loss in piping systems shall not exceed 0.4 KPa per meter (4 feet per 100 feet), whichever is larger, and not less than 1.3 meters per second (4 feet per second).

The use of freeze-point depressant manufactured specifically for HVACR applications shall be used to protect hot water systems from freezing, where extensive runs of piping are exposed to weather, where heating operations are intermittent or where coils are exposed to large volumes of outside air. Freeze protection circulation pump shall be provided along with freeze-point depressant. Heat tracing systems are not acceptable for systems inside the building. Freeze-point depressants solutions found not suitable for use in boilers shall not be used directly in boilers. The water make-up line for freeze-point depressant systems shall be provided with an in-line water meter to monitor and maintain the proper percentage of depressant in the system. Provisions shall be made for drain down, storage and re-injection of the freeze-point depressants into the system.

Radiant Heating Systems

The application of radiant heating systems such as the underfloor hot water radiant heating or overhead gas-fired radiant heating systems shall be consider for high bay areas or open ceiling areas or areas that communicate with the outside, such as loading docks, sallyports, etc. They shall be specified in-lieu of convective or all air heating systems in areas that experience infiltration loads in excess of two air changes per hour at design heating conditions.

Instantaneous Hot Water

The application of point-of-use Instantaneous Hot Water (IHW) generators is permitted for isolated or incidental use at terminal fixtures.

13.6 CHILLED WATER SYSTEMS

The chilled water systems shall consist of chillers, chilled water and condenser water pumps, cooling towers, piping systems, controls, tanks and piping specialties. The chilled water systems shall have a 7.8°C (14°F) temperature differential in the primary system, at the central plant, with a design supply water temperature between 4.4°C and 8.8°C (40°F and 48°F). In climates with low relative humidity, supply water temperature of 8.8°C (48°F) may be used. The chilled water system shall have a 6°C (10.8°F) temperature differential in the secondary systems, at the terminal points of use, such as coils with a design supply water temperature between 4.4°C and 8.8°C (40°F and 48°F). District chilled water, if available, shall be used for cooling only if determined to be economical and reliable through a life cycle cost analysis. Mechanical equipment rooms must be designed in accordance with the requirements of ASHRAE Standard 15: Safety Code for Mechanical Refrigeration. Mechanical code chiller leak detection systems with local alarm notification shall be connected to the HVAC Building Control System with remote alarming.

Coil Freeze Protection

The application of freeze-point depressant manufactured specifically for HVAC applications can be used for freeze protection, primarily in low temperature chilled water systems (less than 4°C) (less than 40°F). The concentration of freeze-point depressant shall be kept to a practical minimum because of its adverse effect on heat exchange efficiency and pump life. The water make-up line for freeze-point depressant systems shall be provided with an in-line water meter to monitor and maintain the proper percentage of depressant in the system. All coils exposed to outside airflow (at some time) shall be provided with freeze protection thermostats and control cycles. Provisions shall be made for drain down, storage and re-injection of the freeze-point depressant into the system.

Condenser Water

All water-cooled condensers must be connected to a recirculating heat-rejecting loop. The heat rejection loop system shall be designed for a 6°C (10.8°F) temperature differential and a minimum of 4°C (7.2°F) wet bulb approach between the outside air temperature and the temperature of the water leaving the heat rejection equipment. Heat tracing shall be provided for piping exposed to weather and for piping down to 3 feet below grade.

13.7 SPECIAL COOLING SYSTEMS

Waterside Economizer Cycle

In certain climate conditions cooling towers are capable of producing condenser water cold enough to cool the chilled water system without chiller operation. This option shall be considered in life cycle cost comparisons of water-cooled chillers. Waterside economizer cycles are particularly cost effective in the low humidity climates of the Western United States. However, where used, any airside economizer shall be set so that no air with a dew point above 9.9°C (50°F) is allowed into the building. Waterside economizer systems shall be used only in areas where the outside air wet bulb temperature is appropriate. Waterside economizers shall utilize a plate heat exchanger piped in parallel arrangement with its respective chiller.

Desiccant Cooling

For high occupancy applications where moisture removal is required, solid desiccant with silica gel may be used in combination with mechanical cooling. Heat recovery wheels may be used prior to the mechanical cooling process. Desiccant cooling units shall be equipped with airflow-setting devices for both process and reactivation air flows, and shall be equipped with gauges or digital displays to report those air flows continuously. The Desiccant Cooling system shall have self-contained microprocessor controls capable of connecting to and interoperating with a direct digital control (DDC) HVAC Building

Control System. Natural gas, steam or condenser waste heat may be used as fuel for reactivation of the desiccant. Lithium Chloride liquid desiccants are not permitted.

13.8 AIR HANDLING SYSTEMS

Zone Air Handling

A dedicated 100 percent outside air capable unit shall be used to maintain positive pressure. The ventilation air for the air-handling unit shall be sized based on maximum occupancy with diversity and shall operate continuously during occupied hours and operate at reduce capacity during unoccupied hours. Industrial grade pressure sensors shall be located at several perimeter areas to communicate outside air pressure to maintain differential positive pressure (adjustable). The internal pressure need only be slightly higher than ambient on average to achieve the goal of excluding humid outdoor air from building openings. In any case, internal pressure shall not be greater than 10 Pascals (0.04" w.c.). Maintain supply air discharge at the unit no more than 10°C (50°F) dew point when outside air dew point is above this temperature. Maintain neutral pressure when the outdoor ambient temperature falls below 2.7°C (37°F) dew point and neutral pressure. Differential pressure sensors and dew point sensors shall be connected to the building automation system. The air-handling unit and the variable volume dampers at the VAV boxes shall have self-contained microprocessor controls capable of connecting to and interoperating with a Native BACnet or LONWORKS direct digital control HVAC building control system. An alarm shall signal if positive or neutral pressures are not maintained, on average, based on multiple samples taken within a five-minute period. The control components shall be specified with industrial grade sensors and transducers.

Special Ventilation Requirements

The ventilation requirements for all building spaces shall comply with the energy code and ASHRAE 62n standards.

- Entrance Vestibules and Lobbies

  The design shall provide sufficient heating and cooling to offset the base load plus the infiltration load of the space. The entrance vestibule shall be positively pressurized relative to atmospheric pressure to minimize infiltration. A variable air volume system shall serve entrance vestibules and lobby spaces. The VAV system shall operate to vary the flow of air for the space through a differential pressure control system designed to maintain positive pressure relative to the outdoors and neutral or negative pressure relative to adjacent spaces. Also provide air-monitoring devices in the unit. The variable volume dampers at the VAV boxes shall have self-contained microprocessor controls capable of connecting to and interoperating with a BACnet or LONWORKS direct digital control HVAC building control system. The control components shall be specified with industrial grade sensors and transducers.

- Atriums

  A dedicated air-handling system shall be provided to control heat gain/loss in the occupancy areas of an atrium. The atrium area shall maintain negative pressure relative to adjacent interior and perimeter spaces or zones and positive or neutral pressure relative to adjacent vestibules and lobbies, and positive pressure relative to the outdoors. The design of the HVAC system must be fully coordinated with the smoke control system.

Smoke Control Systems

The design shall integrate and coordinate the appropriate smoke control management systems if required by the project program requirements and or in accordance to the building and fire codes and local jurisdiction amendments.

Air Distribution Systems

- Variable Air Volume Systems

  The VAV supply fan shall be designed for the largest block load, not the sum of the individual peaks. The air distribution system up to the VAV boxes shall be medium pressure and shall be designed by using the static regain method. All downstream of the VAV boxes the system shall be low and medium pressure construction and shall be designed using the equal friction method. Sound lining is not permitted. A double wall ductwork with insulation in-between is permitted in lieu of sound lining. All VAV boxes shall be accessible for maintenance. A ducted return shall be utilized at all locations. The VAV fan-powered box supply and return ducts shall have double wall ductwork

with insulation in-between for a minimum distance of six feet.

- Terminal VAV Box Volume Control

  The design shall provide particular attention to the volume control. VAV systems depend on air volume modulation to maintain the required ventilation rates and temperature set points. Terminal air volume control devices are critical to the successful operation of the system and shall be provided. All zone loads must be calculated accurately to avoid excessive throttling of airflow and control actuators due to oversized fans and terminal units. Diffusers shall be high entrainment type (3:1 minimum) to maximize air velocity at low flow rates. If ventilation air is delivered through the VAV box, the minimum volume setting of the VAV box shall equal the larger of the following:

  - 25 percent of the peak supply volume:
  - 0.002 m3/s per m2 (0.4 cfm/sf) of conditioned zone area; or
  - Minimum m3/s (cfm) to satisfy Energy Code and ASHRAE Standard 62n ventilation requirements. VAV terminal units must not be shut down to zero when the system is operating.

Airside Economizer Cycle

The airside economizer cycle can reduces cooling costs when outdoor air is below a preset high temperature limit, usually 15 to 21°C (60°F to 70°F), depending on the humidity of the outside air. The airside economizers shall only be used when they can deliver air conditions leaving the air-handling unit of a maximum of 10°C (50°F) dew point and a maximum of 55 percent relative humidity. All air distributions systems with a capacity greater than 1,180 LPS (2,500 CFM) shall have an air-side economizer in accordance with Energy Code and ASHRAE 90.1, unless the design of the air handling systems preclude the use of an airside economizer.

Air Distribution Ductwork

All ductwork shall be designed in accordance with ASHRAE: Handbook of Fundamentals, Duct Design Chapter and constructed in accordance with the ASHRAE: HVAC Systems and Equipment Handbook, Duct Construction Chapter, SMACNA Design Manuals and Mechanical Code. The design shall consider energy consumption, security and sound attenuation in the delineation of all major distribution routing, duct sizing and material selections for the air distribution ductwork.

- Ductwork Pressure Rating

  The ductwork construction shall be tested for leakage prior to final acceptance. Each section tested must have a minimum of a 20-foot length straight-run, a minimum of two elbows and a connection to the terminal. The stated static test pressures represent the pressure exerted on the duct system and not the total static pressure developed by the supply fan. The static test pressure shall be 100 percent of the design pressure exerted on the duct system and not to exceed the designated duct pressure construction class. The primary air ductwork (fan connections, risers, main distribution ducts) shall be medium pressure classification as a minimum. The secondary air ductwork (run outs / branches from main to terminal boxes and distribution devices) shall be low-pressure classification as a minimum. The ductwork down stream of the final distribution devices (VAV and CV boxes) shall not be duct leak tested except for duct sections specified by the Energy Code.

- Duct Leakage Limitations

  The supply, return and exhaust air ducts shall be designed and constructed to allow no more than three percent leakage of total airflow in systems up to 750 Pa (3 inches WG) at design static pressure. In systems from 751 Pa (3.1 inches WG) through 2,500 Pa (10.0 inches WG) ducts shall be designed and constructed to limit leakage to one percent of the total airflow at design static pressure. The pressure loss in ductwork system shall be designed to comply with the criteria stated above. This can be accomplished by using smooth transitions and elbows with a radius of at least 1.5 times the radius of the duct. Where mitered elbows have to be used, double foil sound attenuating turning vanes shall be provided. Mitered elbows are not permitted where duct velocity exceeds 10m/s (2,000 FPM).

- Sizing Methods of Ductwork

All supply and return ductwork shall be sized using the equal friction method except for ductwork upstream of VAV boxes. Duct systems designed using the equal friction method shall allow enough static pressure capacity in the supply and return fans to compensate for improper field installation and changes made to the system layout in the future.

- Ductwork Construction

  Ductwork shall be fabricated from galvanized steel, aluminum or stainless steel sheet metal depending on applications. All fabricated ductwork shall be two gauges thicker than the required in the mechanical code. All ductwork joints and all connections to air handling and air distribution devices shall be sealed with low VOC solvent based duct sealants including all supply and return ducts, any ceiling plenums used as ducts and all exhaust ducts. Water based sealants are not permitted.

  All air distribution devices, non-operational or non-essential prefabricated openings and seam corners shall be sealed with low VOC solvent based duct sealants to minimize air leakage and noise. A factory made UL Class 1 listed acoustical flex duct may be used for low-pressure ductwork in office spaces to connect to air devices. The length of the flex duct shall not exceed eight feet nor contain more than two bends. Joint sealing shall be accomplished using air tight, mechanical joint draw bands for connections. The use of UL approved reinforced fiberglass-backed tape materials or metal foil based tapes with factory-applied mastic materials is permitted.

- Plenum and Ducted Returns

  The design shall ensure that air in a return air plenum is drawn through the most remote register actually reaches the air-handling unit. The horizontal distance from the farthest point in the plenum to a return duct shall not exceed 25 feet. No more than 0.4 m3/s (1,000 cfm) shall be collected at any one return grille. Return air plenums shall be avoided. When deemed necessary, all plenums shall be sealed airtight with respect to the exterior wall and roof slab or ceiling deck to avoid creating negative air pressure in exterior wall cavities that would allow intrusion of untreated outdoor air. All central multi-floor-type return air risers must be ducted. The design shall provide ducted returns for less flexible building spaces, such as permanent circulation, public spaces, support spaces and ancillary spaces. Where fully ducted return systems are used, consider placing returns low in walls or on columns to complement ceiling supply air. Return air ducts above the ceiling and below the roof shall be insulated per the Energy Code. Double wall ductwork with insulation in-between shall be considered in lieu of sound lining for a minimum five feet before connecting to the air handling unit or a return air duct riser.

- Ductwork Support and Seismic Bracing

  The ductwork support and seismic bracing system shall be a pre-engineered support and seismic restrain system approved for suspended non-structural building component utilities systems.

- Ductwork Identification Labeling

  The ductwork system and associated system equipment shall be identified with marker in accordance to ANSI A13.1. The labels shall not be less than 1.5-inch high letter for ductwork, not less than .75-inch high letters for access doors and not less than one-inch high for equipment. The ductwork system labels shall be installed at 30-foot intervals.

13.9 PUMPING SYSTEMS

Pump and Piping Systems

The system shall utilize parallel piping systems with a two-pipe main distribution system arranged in a reverse return configuration. Series loop piping for terminal or branch circuits shall be equipped with automatic flow control valves at terminal units (all types of heat transfer units). Reverse return is considered because it provides the best overall control and maintenance of a balanced system as the system is modified. Each terminal unit or coil shall be provided with isolation valves at each piece of equipment, on both the supply and return lines and a flow-indicating balance valve on the return line. Isolation valves shall be provided on all major pipe branches, such as at each floor level, building wing or mechanical room. Each pumping system shall be provided with two pumps, one operating while the other is in standby mode. These pumps shall be configured for automatic lead/ lag operation. Each boiler shall be provided with a control and piping arrangement, which protects the

boiler from thermal shock. A primary-secondary piping arrangement with a modulating mixing control valve and higher primary flow rate shall assure that the boiler return water temperature does not drop too low, as commonly occurs with night setback.

A hydronic hot water space heating pumps shall be selected to operate at 1750 RPM.

Variable volume pumping systems shall be provided for all secondary-piping systems with pump horsepower greater than 10 KW (15 HP).

Pressurized diaphragm expansion tanks shall be used when available in appropriately sized manufactured products.

Air separators and vents must be provided on hot water systems to remove accumulated air within the system. Automatic bleed valves shall only be used in accessible spaces in mechanical rooms where they can be observed by maintenance personnel and must be piped directly to open drains.

A manual bleed valves shall be used at terminal units and other less accessible high points in the system. Air vents shall be provided at all localized high points of the piping systems and at each heating coil. Likewise, system drains shall be provided at all localized low points of the heating system and at each heating coil.

Hydronic Closed Loop Systems

Closed piping systems are unaffected by static pressure; therefore, pumping is required only to overcome the dynamic friction losses. Pumps used in closed loop hydronic piping shall be designed to operate to the left of the peak efficiency point on their curves (higher head, less flow). This compensates for variations in pressure drop between calculated and actual values without causing pump overloading. Pumps with steep curves shall not be used, as they tend to limit system flow rates.

Variable Flow Pumping

Variable flows occur when two-way control valves are used to modulate heat transfer. The components of a variable volume pumping system include pumps, distribution piping, control valves and terminal units, and shall also include boilers and chillers unless a primary-secondary arrangement is used. All components of the system are subject to variable flow rates. It is important to provide a sufficient pressure differential across every circuit to allow design flow capacity at all times. Flow may be varied by variable speed pumps or staged multiple pumps. Pumps shall operate at no less than 75 percent efficiency on their performance curve. Variable flow pumping must be designed carefully. Package systems shall be used, complete with pumps and controls, factory-tested prior to shipment. Chillers and most boilers may experience flow-related heat exchange problems if flow is not maintained above a minimum rate. For this reason, separate, constant flow primary water pumps are recommended for variable volume pumping systems.

Primary and Secondary Pumping

In this application, primary and secondary pumping circuits are separate, with neither having an effect on the pumping head of the other. The primary circuit serves source equipment (chiller or boiler), while the secondary circuit serves the load. Primary and secondary pumping arrangements allow increased system temperature design drops, decreased pumping horsepower and increased system control. The primary loop and pumps are dedicated and sized to serve the flow and temperature differential requirements of the primary source equipment. This permits the secondary pump and loop to be sized and controlled to provide the design flow rate and temperature differential required to satisfy the heating or cooling loads. Primary and secondary systems are recommended for larger buildings (circulation of more than 38 L/s (500 gpm) and campus facilities.

Piping Systems

All piping systems shall be designed and sized in accordance with ASHRAE Fundamentals Handbook and the ASHRAE HVAC Systems and Equipment Handbook. Materials acceptable for piping systems are black steel and copper. No PVC or other types of plastic pipe are permitted.

Chilled Water and Condenser Water Piping

HVAC systems shall utilize parallel piping systems with a two-pipe main distribution system arranged in a reverse return configuration. If applied, series loop piping for terminal or branch circuits shall be equipped with automatic, pressure independent, flow control valves at terminal units (all types of heat transfer units). Each terminal unit or coil shall

be provided with isolation valves on both the supply and return and a flow indicating balance valve on the return line. Isolation valves shall be provided on all major branches, such as at each floor level, building wing or mechanical room.

Chilled Water HVACR Distribution Systems

The pumping and piping arrangement shall utilize the appropriate sizing criteria to accommodate the application of a constant volume primary pumping and variable volume secondary pumping system. The primary and secondary circuits shall be separate, with neither having an effect on the pumping head of the other. The primary circuit serves the source equipment (chillers), while the secondary circuit serves the loads.

Piping Support and Seismic Bracing

The piping support and seismic bracing system shall be a pre-engineered support and seismic restrain system approved for suspended non-structural building component utilities piping larger than two inches in size.

Isolation of Piping at Equipment

Isolation valves, shutoff valves, by-pass circuits, flanges and unions shall be provided as necessary for piping at equipment to facilitate equipment repair and replacement. Equipment requiring isolation includes boilers, chillers, pumps, coils, terminal units and heat exchangers. Valves shall also be provided for zones off vertical risers.

Provisions for Piping in Earthquake Zones

In Seismic Zones 2, 3 and 4, sleeves for pipes shall be at least 1.5 inch larger than the pipe, to allow for movement. Flexible couplings shall be provided at the bottom of pipe risers. Spreaders shall be used to separate adjacent pipes, unless the distance is large enough to prevent contact in an earthquake.

Piping Supports

Provide channel supports for multiple pipes and heavy-duty steel trapezes to support multiple pipes in accordance to the designated seismic zone requirements of the Building Code. Hanger and support schedule shall have manufacturer's number, type and location. Comply with MSS SP69 for pipe hanger selections. Spring hangers with supports for piping equal or large than two inches in size shall be provided in all the mechanical rooms.

Flexible Pipe Connectors

Flexible pipe connectors shall be fabricated from annular close pitched corrugated and braided stainless steel. All pumps, chillers, and cooling towers shall have flexible connectors.

Piping System and Equipment Identification

All pipes, valves and equipment in mechanical rooms, shafts, ceilings and other spaces accessible to maintenance personnel must be identified with color-coded bands and permanent tags indicating the system type and direction of flow for piping systems or type and number for equipment per ANSI color and labeling standards and the plumbing code. The identification system shall also tag all valves and other operable fittings. Gas piping and sprinkler lines must be identified as prescribed by fire code.

Thermal Insulation

All insulation materials shall comply with the fire and smoke hazard ratings indicated by ASTM-E84, NFPA 255 and UL 723. Accessories such as adhesives, mastics, cements and tapes shall have the same or better fire and smoke hazard ratings. Insulation shall be provided on all cold surface mechanical systems, such as ductwork and piping, where condensation has the potential of forming and in accordance with ASHRAE Standard 90.1.and the Energy Code. Insulation that is subject to damage or reduction in thermal resistively if wetted shall be enclosed with a vapor seal (such as a vapor barrier jacket). Insulation shall have zero permeability.

- Duct Insulation

  All duct insulation materials used, as internal insulation exposed to the air stream shall be in accordance with UL 181 or ASTM C 1071 erosion tests. The materials shall not promote or support the growth of fungi or bacteria, in accordance with UL 181 and ASTM G21 and G22. All exposed externally insulated ductwork shall have sealed canvas jacketing. All concealed externally insulated ductwork shall have foil face jacketing. The insulation shall comply with fire and smoke hazard ratings indicated by ASTM-E84, NFPA 255 and UL 723. Accessories such as adhesives, mastics, cements, tapes, etc. shall have the same or better component ratings. All supply air ducts

must be insulated, in accordance with ASHRAE Standard 90.1.and the energy code. Supply air duct insulation shall have a vapor barrier jacket. The insulation shall cover the duct system with a continuous, unbroken vapor seal. Insulation shall have zero permeability. All ductwork exposed to the weather shall be protected with aluminum jacketing and seams sealed. All return air and exhaust air distribution systems shall be insulated in accordance with ASHRAE Standard 90.1.and the energy code. The insulation of return air and exhaust air distribution systems needs to be evaluated for each project and for each system to guard against condensation formation and heat gain/loss on a re-circulating or heat recovery system. All equipment, heat exchangers, converters and pumps shall be insulated as per ASHRAE Standard 90.1.and the energy code.

- Piping Insulation

  All insulation material shall comply with the fire and smoke hazard ratings indicated by ASTM-E84, NFPA 255 and UL 723. Accessories such as adhesives, mastics, cements, tapes, etc. shall have the same or better component ratings. All piping systems must be insulated in accordance with ASHRAE Standard 90.1.and the energy code. All piping systems that conveying fluids, those having design temperatures less than 18°C (65°F) or greater than 30°C (86°F) shall be insulated. All piping systems with surface temperatures below the average dew point temperature of the indoor ambient air and where condensate drip will cause damage or create a hazard shall be insulated with a vapor barrier to prevent condensation formation regardless to whether piping is concealed or exposed. All chilled water piping systems shall be insulated with non-permeable insulation (of perm rating 0.00) such as foam glass or polyisocyanurate materials. All exposed and concealed piping shall have PVC jacketing. All insulated piping exposed to the weather shall be protected with aluminum jacketing and seams sealed.

- Equipment Insulation

  All insulation material shall comply with the fire and smoke hazard ratings indicated by ASTM-E84, NFPA 255 and UL 723. Accessories such as adhesives, mastics, cements, tapes, etc. shall have the same or better component ratings. All equipment including air handling units, chilled and hot water pumps, and heat exchangers must be insulated in accordance with ASHRAE Standard 90.1.and the Energy Code. All pumps shall have jacketing.

- Thermal Pipe Insulation for Plumbing Systems

  All sanitary sewer vents terminating through the roof shall be insulated to prevent condensation from forming and include a vapor barrier jacket on this insulation. All Insulation materials and accessories shall comply with the fire and smoke hazard ratings indicated by ASTM-84, NFPA 255 and UL 723. All domestic water piping shall be insulated in accordance with ASHRAE 90.1.and the Energy Code. All piping exposed in plenums or above ceiling shall be insulated to prevent condensation. All insulation materials and accessories shall comply with the fire and smoke hazard ratings indicated by ASTM-E84, NFPA 255 and UL 723.

13.10 VIBRATION ISOLATION, ACOUSTICAL ISOLATION, AND SEISMIC DESIGN FOR MECHANICAL SYSTEMS

Refer to and incorporate the basic design techniques as described in ASHRAE Applications Handbook, Sound and Vibration Control. Isolate all moving equipment in the building. For HVAV noise criteria, see "Design Guidelines for HVAC-Related Background Sound in Rooms." Also, for design criteria, refer to "Selection Guide for Vibration Isolation," ASHRAE 99 Application Handbook.

Mechanical Room Isolation

A floating isolation floors shall be considered for major mechanical rooms located in penthouses or at intermediate levels or mid-rise construction.

Mechanical Shafts and Chases

The mechanical shafts and chases shall be closed at top and bottom, as well as the entrance to the mechanical room. Any piping and ductwork shall be isolated as it enters the shaft to prevent propagation of vibration to the building structure. All openings for ducts and piping must be sealed. Shafts dedicated to gas piping must be ventilated.

Isolators

The isolators shall be specified by type and by de-

flection, not by isolation efficiency. See ASHRAE Guide for Selection of Vibration Isolators and Application Handbook for types and minimum deflections. Specifications shall be worded so that isolation performance becomes the responsibility of the equipment supplier.

Concrete Inertia Bases

The design shall delineate Inertia bases for reciprocating and centrifugal chillers, air compressors, all pumps, axial fans above 300 RPM, and centrifugal fans above 37 KW (50 HP).

Ductwork

The design shall delineate the methods to reduce fan-generated noise immediately outside any mechanical room wall by acoustically coating or wrapping the duct. The ductwork design shall appropriately address the airborne generated equipment noise, equipment vibration, duct borne fan noise, duct breakout noise, airflow generated noise and duct borne cross talk noise. All ductwork connections to equipment having motors or rotating components shall be made with aligned, six-inch length, double walled UL labeled, flexible connecters. All ductwork within the mechanical room or serving courtrooms shall be supported with isolation hangers in accordance to the building code.

Piping Hangers and Isolation

The design shall delineate the isolation hangers for all piping in mechanical rooms and adjacent pipe rack spaces. The pipe hangers closest to the equipment shall have the same deflection characteristics as the equipment isolators. Other hangers shall be spring hangers with .75 inch deflection. Positioning hangers shall be specified for all piping eight inches and larger throughout the building. Spring and rubber isolators are recommended for piping two inches and larger hung below noise sensitive spaces. Floor supports for piping may be designed with spring mounts or rubber pad mounts. For pipes subject to large amounts of thermal movement, plates of Teflon or graphite shall be installed above the isolator shall permit horizontal sliding. The piping and equipment anchors and guides for vertical pipe risers usually must be attached rigidly to the structure to control pipe movement. Flexible pipe connectors shall be designed into the piping before it reaches the riser.

Noise Control in VAV Systems

The system generated sound levels at maximum flow must be carefully evaluated to ensure acoustic levels. Inlet guide vanes shall be evaluated for noise in their most restricted position. Duct noise control shall be achieved by controlling air velocity, by the use of sound attenuators and by not over sizing terminal units. Terminal units shall be selected so that design air volume is approximately three-quarters of the terminal box's maximum capacity. Volume dampers in terminal units shall be located at least six feet from the closest diffuser and the use of grille mounted balance dampers shall be restricted except for those applications with accessibility problems.

VAV Box Sound Attenuation

The VAV boxes and associated attenuation lining shall incorporate fiber free insulation or foil faced insulation duct materials. The attenuation materials shall be appropriately sealed and covered with either reinforced aluminum laminated foil liner or coated with water based sealant tested and approved for air erosion per UL181or ASTM C 1071. The materials shall not promote or support the growth of fungi or bacteria, in accordance with UL 181 and ASTM G21 and G22. All exposed edges shall be sealed with sealant approved per NFPA 90A.

Courthouse Noise Transmission Attenuation

A dedicated and sound rated certified noise attenuator shall be provided to limit transmission to and from courtrooms, judges' chambers, jury rooms, and prisoner consulting rooms and from holding areas.

Thermometers and Gauges Instrumentation

Every piece of mechanical equipment shall be provided with instrumentation that includes ISA data sheets and or permanent test ports to verify critical parameters, such as capacity, pressures, temperatures, and flow rates. Following are the general instrumentation requirements: Thermometers and pressure gauges are required on the suction and discharge of all pumps, chillers, boilers, heat exchangers, cooling coils, heating coils, and cooling towers. To avoid pressure gauge tolerance errors, a single pressure gauge may be installed, valve to sense both supply and return conditions. For coils with less than ten GPM flows, provide permanent provisions for use of portable instruments to check temperatures and pressures shall be provided. A duct static pressure

gauge assemblies shall be provided for the central air-handling unit air supply fan discharge, branch take-offs of vertical supply risers and at all duct locations at which static pressure readings are being monitored to control the operation of a VAV system. A differential static pressure gauge assemblies shall be placed across filters in air-handling units and to measure building pressure relative to the outdoors. A temperature gauge is required at the outside air intake to each air-handling unit.

Air Flow Measuring Devices

Airflow measuring grids are required for all central air-handling units. Measuring grids shall be provided at the outside air supply duct, supply air duct, return air duct, main distribution ducts to branch mains by floor or major zone and the outside air duct by accurate 'DP' sensor or VFD controlled injection fan. Airflow measuring grids must be sized to give accurate readings at minimum flow.

Water Flow Measuring Devices

Water flow or energy measuring devices shall be required for each chilled water refrigeration machine, hot water boiler, pump, and connections to district energy plants. Individual water flow or energy measuring devices shall be provided for chilled water lines serving computer rooms and chilled water and hot water lines to out leased spaces. Flow measuring devices shall be capable of communicating with the central HVACR Control System. Water flow and airflow measuring devices shall confirm or validate the Energy Code and ASHRAE 90.1 requirements.

Acceptance Testing Stations

A permanent testing station for airflow and water flow shall be provided for start up and testing of building systems. Connections shall be designed so temporary testing equipment can be installed and removed without shutting down the system.

Indoor Air Quality Measurement

All enclosed sallyports and parking garages shall be equipped with ventilation systems controlled by carbon monoxide detection and alarming systems. The carbon monoxide sensors shall be uniformly located throughout the enclosed space and near each stairwell and elevator lobby connecting to the garage and sallyport.

Plumbing Systems Criteria

The plumbing design shall evaluate the potential value of incorporating design features to minimize the impact of localized airborne chemical, biological or radiological attacks. Provide protection and tamper resistance design for all vent discharge openings , and secure and controlled access for all active plumbing and piping systems components (pumps, strategic isolation valves, piping systems, controllers, boilers, control valves, industrial trap primers, manholes, strategic utilities interface locations). The criteria shall provide guideline to located plumbing and piping vents to minimize the entrainment of fumes, moisture and particles from the vent discharge piping to the building HVACR system air intakes.

Plumbing and Piping Identification Labeling

All plumbing, piping, valves and equipment shall be identified with labels and tags in accordance to ANSI A13.1. The labels shall not be less than one-inch high letter for piping, not less than .75- inch high letters for access doors and not less than one-inch high for equipment. The piping system labels shall be installed at 30-foot intervals.

13.11 DOMESTIC WATER SUPPLY SYSTEMS

Domestic water supply equipment shall include, but not be limited to, the following equipment:

- Hot water heaters
- Pressure booster systems
- Pressure regulating valves
- Circulating pumps
- Back flow prevention device with tamper resistance-protected enclosures
- Industrial automatic trap priming systems
- Balancing valves
- Isolation valves
- Strainers
- Hangers and supports
- Seismic restraints
- Thermal insulation

Water hammer arrestors shall be provided at every branch to multiple fixtures and on every floor for both hot and cold water. Domestic cold and hot water distribution systems shall be insulated per ASHRAE 90.1 and all exposed piping shall have PVC jacketing.

Cold Water Service

Cold-water service shall consist of a pressurized piping distribution system incorporating a separate supply line from the tap in the existing outside water main to the equipment area inside the building. The water meters furnished by the local department of public works shall meter water service inside the facility property boundaries. Incoming service shall have approved backflow prevention device. The irrigation systems must be sub-metered for deduct billing of the sewer system. The internal distribution shall consist of a piping system that will supply domestic cold water to all necessary plumbing fixtures, water heaters and all mechanical make-up water needs. The distribution system shall include equipment that is capable of maintaining adequate pressure and flow in all parts of the system in accordance with plumbing code. The duplex booster pumping system shall be utilized if the water pressure is not adequate to provide sufficient pressure at highest, most remote fixture. The water pressure at the fixture shall be in accordance with the Plumbing Code.

Hot Water Service

Heaters utilizing natural gas, electricity or steam as an energy source shall generate hot water. Selection shall be supported by an economic evaluation incorporating first cost, operating costs and life cycle costs in conjunction with the HVAC energy provisions. Instantaneous hot water heaters are not permitted as a primary source. Domestic hot water supply temperature shall be generated at 60°C (140°F), and shall be capable of tempered water to at least 49°C (121°F) using a three-way mixing valve, before supplying to all plumbing fixtures. Heat pump hot water heaters shall be used where possible to save energy. For incidental use, the use of instantaneous hot water heaters is permitted. Distribution system shall consist of a piping system, which connects water heater or heaters to all plumbing fixtures as required. Circulation systems or temperature maintenance systems shall be included. Hot water shall be available at the furthest fixture from the heating source within 10 seconds of the time of operation.

13.12 SANITARY WASTE AND VENT SYSTEM

Waste Pipe and Fittings

A complete sanitary collection system shall be provided for all plumbing fixtures, floor drains and kitchen equipment designed in compliance with applicable codes and standards. Piping shall be cast iron soil pipe with hub and spigot joints and fittings. Above ground piping may have heavy-duty no-hub joints (ASTM C1540-02) and fittings.

Floor Drains

Floor drains shall be provided in multi-toilet fixture restrooms, mechanical equipment rooms, locations where condensate from equipment collects, and parking garages and ramps. Single fixture toilet rooms do not require floor drains. In general, floor drains shall be cast iron body type with 6-inch diameter nickel-bronze strainers for public toilets, kitchen areas and other public areas. Equipment room areas shall require large diameter cast iron strainers and parking garages shall require large diameter tractor grates. Drainage for ramps shall require either trench drains or roadway inlets when exposed to rainfall. Automatic trap primer system shall be provided for all floor drains and air handler p-traps where drainage is not routinely expected from spillage, cleaning, continuous condensate or rainwater.

Sanitary Waste Equipment

Specific drains in kitchen areas shall discharge into a grease interceptor before connecting into the sanitary sewer in accordance with the requirements of the state health department and local authorities will determine which drains. Floor drains and/or trench drains in garage locations are to discharge into sand/oil interceptors.

Automatic Sewage Ejectors

Sewage ejectors shall only be used where gravity drainage is not possible. If they are required, only the lowest floors of the building shall be connected to the sewage ejector; fixtures on upper floors shall use gravity flow to the public sewer. Sewage ejectors shall be non-clog, screen less duplex pumps, with each discharge not less than 100 mm (4 inches) in diameter. They shall be connected to the emergency power system if available.

Rainwater Drainage System

- Pipe and Fittings

  Piping system shall be in compliance with local codes and sized based upon local rainfall intensity.

- Roof Drains

  Roof Drains shall be cast iron body type with high dome grates and membrane clamping rings, manufactured by any of the major foundries. Each roof drain shall have a separate overflow drain located adjacent to it. Overflow drains shall be the same drains as the roof drains except that a damming weir extension shall be included.

- Rainwater Drainage Equipment

  Foundations drainage system with perforated drain tile collecting into a sump containing a pumping system as required by the applicable Codes shall be provided.

Plumbing Fixtures

All plumbing fixtures and faucets shall be water efficient type. Provide permanently wired automatic flush valves with optional manual flush activation for water urinals and water closets and automatic faucets in public toilet rooms.

Natural and Propane Gas Systems

- Service Entrance

  A gas piping entering the building must be protected from accidental damage by vehicles, foundation settlement or vibration. Where practical, the entrance shall be above grade and provided with a self-tightening swing joint prior to entering the building. Gas piping shall not be placed in unventilated spaces, such as trenches or unventilated shafts, where leaking gas could accumulate and explode. The provision of a seismic gas shutoff valve is not required in for facilities that conform to the following provisions of the Building and Fire Codes

  - The building structure is classified as a 1 hour rated classification
  - The building has an approved and operational Fire Sprinkler system

- Gas Piping within Building Spaces

  All gas shall not be piped through confined spaces, such as trenches or unventilated shafts. All spaces containing gas-fired equipment, such as boilers, chillers and generators, shall be mechanically ventilated. Vertical shafts carrying gas piping shall be ventilated. Gas meters shall be located in a sealed gas meter room, thus avoiding leakage concerns and providing direct access to the local gas utility. All gas piping inside ceiling spaces shall have plenum rated fittings. All diaphragms and regulators in gas piping must be vented to the outside.

Fuel Oil Systems

- Fuel Oil Piping

  All fuel oil-piping system shall use at least schedule 40 black steel or black iron piping. Fittings shall be of the same grade as the pipe material. Valves shall be bronze, steel or iron and may be screwed, welded, flanged or grooved. double-wall piping with a leak detection system shall be used for buried fuel piping. Duplex fuel-oil pumps with basket strainers and exterior enclosures shall be used for pumping the oil to the fuel burning equipment.

- Underground Fuel Oil Storage Tanks

  All underground fuel oil storage tanks shall be of double wall, non-metallic construction or contained in lined vaults to prevent environmental contamination. Tanks shall be sized for sufficient capacity to provide 48 hours of system operation under emergency conditions. For all underground tanks and piping systems, a leak detection system with monitor and alarm systems shall be required. The installation must comply with local, state and federal requirements.

- Emergency Diesel Generators Systems with above Grade Fuel Storage Tank

  The generator shall be EPA certified generator system and manufactured by ISO 9000 certified manufacturer. The sizing capacity of each generator system shall be determined on a case-by-case application driven by the project program. The fuel storage capacity of each generator system shall be determined by the availability of timely fuel

deliveries, the determination of the appropriate operational /climatic durations and the emergency response plans scenarios of the system. The location of the generator system exhaust discharge shall be selected to minimize the potential of entrainment of exhaust fumes into the building outside air takes. The requirement of additional external fuel tanks for the generator system shall be located adjacent to the generator in accordance to current and applicable Fire Code, UL listings for double containment tanks, regulatory compliance leak detection systems and compliance to local environmental ground water and air regulations. The generator system shall include a low fuel level alarm and automatic engine shutdown with external notification capabilities. The complete generator system shall be designed and manufactured at ISO 9001 certified facilities. The complete generator system shall be factory tested to design specification at full load conditions. The generator system shall be equipped with an integrated, vibration isolated, NEMA 1 enclosure, and control system. The generator system air take shall include Drip Proof Generator Air Intake System, NEMA 2 rated. The complete generator system excluding the external fuel tank shall be provided with a two-year manufacturer's warrantee.

13.5 ACCEPTANCE TESTING

The HVAC system acceptance testing shall incorporate design-testing elements from the Pacific Gas and Electric Company: California Title 24 Energy Code, Non-Residential Mechanical and Acceptance Test Requirements

Acceptance Duct Leak Testing

The HVAC system duct work upstream of the VAV boxes and all medium pressure classified duct work shall be tested to ensure that total leakage does not exceed 1 percent of the total design airflow at 130 percent of the design pressure of each system.

Indoor Air Quality Acceptance Testing

Specify IAQ testing requirements for CO, CO2, volatile organic compounds, NO2 and O3.

Confirmation of Performance

The A/E shall specify and field validate the functional acceptance test requirements on each air distribution and hydronic system to ensure that the design conforms to the established operational requirements of the design. Validate the performance of the HVAC system conforms to the approved design measures of the energy efficiency requirements of the Energy Code. Specify IAQ testing requirements for CO, CO2, volatile organic compounds, NO2 and O3.

Acceptance Startup: Testing, and Balancing Equipment

Specify that factory and or manufacturers' startup representatives are present for startup of all major equipment, such as boilers, chillers, air handlers and DDC HVAC Building Control Systems.

System testing and balancing shall be the responsibility of the designer. Adequately specify testing, adjusting and balancing resulting in not only proper operation of individual pieces of equipment, but also the proper operation of the overall HVACR and plumbing systems, in accordance with the design intent. The testing and balancing contractor shall have up to date certification by Associated Air Balance Council (AABC)

Specify on-site factory and functional acceptance performance testing of all equipment and systems including chillers, boilers, HVACR Control System and other systems for part load and full load during summer, winter, spring and fall season as per the schedules specified by the engineer. Specify the services of an organization certified by AABC. Specify the services of a certified, third party duct leak-testing agency.

Test and Balance Certification Requirements

All work is to be performed under the direct daily on-site supervision of an AABC Certified Test and Balance Engineer (TBE).

- All testing, adjusting and balancing to be performed by AABC Certified Technicians. Certificates to be provided to project for review and approval.
- Copy of the AABC National Guaranty to be included in the report with originals being provided to the project Mechanical Engineer and the Owner. Follow up by the AABC via the TAB company's participation in the AABC Quality Assurance Program is also required.

13.13 REPORT REQUIREMENTS

Each system is to be tabbed and reported with a cover sheet of rooms or areas served reflecting calculated

room areas, volumes, supply air totals, calculated air change rates and relative space pressures. All associated equipment, pressure gradients and areas to be reported tabbed for each area.

- All rooms that required room pressure gradients are to be tested, adjusted and confirm in the report. Pressures to be reported in absolute reference.
- All rooms supply air sub-totaled for quick reference and air change rate calculations.
- All air moving equipment to be reported including a system component schematic with static pressure profile showing all final test data.
- All air distribution systems shall include a colored CAD schematic floor plan coded by system identifying all test locations in the report. All supply, return, exhaust and special systems must be identified by different colors.

13.14 SERVICE REQUIREMENTS

- Provide all initial ("as found") supply, return and exhaust readings to be documented in the final report.
- Provide verification that duct pressure testing is being completed within design parameters using calibrated instrumentation.
- Inspect damper installation and locations for accuracy and adequate access.
- Assist control contractor in commissioning of control system essential to maintaining system balance, i.e. DP sensors and airflow monitoring stations.

AHU Component Items	Minimum Requirements
Prefilters	ASHRAE 52.2 -1999, Rigid filters, 45percent Rated > MERV 10, low pressure drop, non electrostatic charged media. MERV 10Filters: rated at 500 FPM: 0.09 inch W.C. clean, 1.0 inch W.C. dirty, 1089 grams minimum dirt holding capacity
Outside Air Make-Up Dampers	Low-Leakage, Control Dampers
Preheat Coils (optional when applicable due to climatic conditions)	Copper Tube/Copper Fins 0.049inch/.010 - 6 fins/inch

Table 13.1 AHU Matrix

AHU Component Items	Minimum Requirements
Preheat Coil Drain Pan (Optional when applicable to climatic conditions)	Stainless Steel 304, Double Sloped - No Standing Water Design , greater than 1/4-inch per foot Minimum slope, 16 gauge
Steam Humidifier section (Optional when applicable to climatic conditions)	Stainless Steel 304 Grid Type (Dri-Steem, Ultrasorb or approved equal)
Supply and or Return Fan System	Backward curved - non overloading
Supply Fan Type	New York or Twin City or Approved Equal : Aluminum Airfoil Type - Direct Drive preferred, Continuous Welded Scroll Section, No bolts or screws protruding into the air stream
Fan Wheel Protection	Fan Wheel Enclosure and Fenced Inlet and Outlet, Cal OSHA Title 8, General Industrial Safety Orders, Subchapter 7, Group 6, Article 41
AHU Fan Drive Vibration Monitor System (optional for fan motors >50hp	Remote 3D Accelerometer Sensor network to the exterior AHU control output cabinet
Fan Isolation (Vertical/Horizontal)	greater than 2-inch Spring height with seismic rated captive
Cooling Coils (10 fins maximum)	Copper Tube/Copper Fins 0.035/0.008-inches
Cooling Coil Fins	0.008-inch, 10 fins/inch maximum
Coil Casing	Stainless Steel 304 Construction
Coil Access	Field cleanable and side access removable without cutting and welding
Cooling Coil Drain Pan	Stainless Steel 304, 14 Gauge Construction, Double Sloped - No Standing Water Design, greater than 1/4-inch per foot Minimum Slope, Pan extends at greater than 4-inch downstream and 2-inch
Prefilter Frames	Front Loading Type: Powder Coated Finish - Aluminum construction, or 316 Stainless Steel construction, incorporating knife edge with permanently attached Aluminum, Powder Coated Finish or 316 Stainless Steel Finished, Hinged clips that interlocking with filter header, less than 1.5percent bypass leakage at 6-inch of static pressure
Post Filter Frames	Front Loading Type: Powder Coated Finish - Aluminum construction, or 316 Stainless Steel construction, incorporating knife edge with permanently attached Aluminum, Powder Coated Finish or 316 Stainless Steel Finished, Hinged Clips, that interlocking with filter header, less than 0.5percent bypass leakage at 6-inch of static pressure
PreFilter and Post Media Gaskets	Closed Celled Neoprene or EPDM Gasket, Bonded to filter media assembly header
AHU Casing: Double Wall Construction, Internal Wall Insulation, Solid Smooth Interior, Wipe Down and Cleanable Surfaces	Aluminum, Galvanized Steel, Manufacturer shall provide calculations certifying the Internal insulation meets of exceeds a 0.08 U factor.
AHU Flooring (3/16" Minimum thickness): Flooring: No oil canning floor with 300 pound - 1ft single point load	Aluminum with Aluminum Casing or 304 Stainless Steel with Galvanized Steel Casing

Table 13.1 (cont.) AHU Matrix

AHU Component Items	Minimum Requirements
AHU Interior Lighting	Fluorescent T8 or T5 Lighting fixture, NEMA 3R housing with exterior mounted control switch
Supply Fan Motors (TEFC)	Label for Inverter Duty, High Efficiency, TEFC less than 2 HP , Premium High Efficiency, TEFC greater than 3 HP with sealed
Fan Access for > 20 HP Motors	Overhead Support Beam to allow for the removal motor and fan assemblies
AHU Door Access	Each Section - Double Gasket Closed Cell Neoprene
AHU Under Floor Insulation	Equal to U-factor of walls
Final Filtration Requirements	ASHRAE 52.2 -1999, Rigid filters, 85percent rated greater than MERV 13, low pressure drop, non electrostatic charged media, MERV 13 Filters: rated at 500 FPM: 0.26-inch, W.C. clean, 1.0-inch dirty, 818 grams minimum dirt holding capacity.
Indoor Air Quality/ Threat Reduction Modules: (Optional based on threat assessment)	Germicidal, High Performance, Low Pressure Air Purification System, High Voltage Charged, Grid Modules, greater than MERV 15 rated
AHU Frame Deflection	Greater than 1/240 of overall length
Cooling Coil and Filter Velocity	less than 475 FPM
AHU Casing Leakage	less than 1percent of total design air flow
AHU VSD Inverter	Allen Bradley Powerflex or ABB ACH 550 with integral bypass switch assembly or approved equal
AHU Under Floor Insulation	Compressed Fiber or Expanded Foam type
Seismic Design (California)	Zone TBD , C-Factor less than TBD
AHU Coil Piping	Gasketed Casing Penetrations and Insulated Piping
AHU Mixing Section Drain Piping	Floor Drain capped and pipe and slope to exterior with thread cap
AHU Cooling Drain Pan Piping	Piped and sloped to exterior for connection
AHU Coil Section Drain Piping	Floor Drain capped and pipe and slope to exterior with thread cap
Electrical Controls	Install all designated interconnection color coated / numbered wiring between electrical components for testing and factory commissioning
Factory Acceptance Testing and Pre-Commissioning Documentation Reports	♦ 130percent of Design Static Pressure Testing of Unit Casing and Water Leak Test ♦ Design Airflow Leak Test at 1percent percent and Sound Test ♦ 24 hour VFD Ramp Test, 0.33 Mil P-P Vibration Test
Warrantee	24 months from date of shipment from factory: 18 months from startup: 12 months from completed on site acceptance testing
Factory Cleaning & Packaging for Shipping	Surface Wipe Down of Interior, Vacuum Clean Interior, Provide Protection of Openings, Exterior Shrink Wrap for Shipping, Dedicated trucking to the Jobsite

Table 13.1 (cont.) AHU Matrix

14

AUTOMATIC CONTROL SYSTEMS

chapter photo

San Francisco Superior Court
San Francisco, CA
RossDrulisCussenbery Architects

14. HVACR AUTOMATIC CONTROL SYSTEMS DESIGN CRITERIA

This section identifies the program and design criteria for Heating, Ventilating, Air Conditioning and Refrigeration (HVACR) Direct Digital Building Control Systems.

14.1 OBJECTIVES

The following criteria shall be used in designing and selecting the HVACR Building Control System. An HVACR Control System is not required for every project and shall be evaluated based on the size and complexity of the building. The size and the complexity of the HVACR system, number of pieces of equipment, expected energy savings and availability of trained staff shall all be considered before a decision is made.

A new control system shall be Direct Digital Controls (DDC) and be an open system, protocol neutral, non-proprietary for interoperability, meaning the ability of disparate control system devices to work together toward a common objective through the digital exchange of relevant information. It will allow third party protocol acceptance and processing of inputs from devices supplied by different vendors.

The control system shall comply with ASHRAE/ANSI/ISO Standard 135n: BACnet or Lonmark by Echelon and ANSI/EIA/CEA -709.1-B-2000 standards, including addenda to these standards. Other applicable codes are California Code of Regulations, Title 24 / NEC, UL916 and FCC part 15, subpart J, class A.

The control system shall consist of a series of direct digital microprocessor controllers, central processing station, interconnected by a high-speed Local Area Network (LAN). The HVACR control system shall be accessible through a web browser. The control system shall have a graphical user interface (GUI) that provides trending, scheduling, downloading instructions to field devices, real-time 'live' colored graphic programs, parameter changes of properties, set point adjustments, alarm notification, alarm event information, confirmation of operators, data collection, data storage and execution of global commands.

The control systems design shall include a cabling network that complies with EIA/TIA-862: Building Automation Systems Cabling Standards for Commercial Buildings.

Level of Integration

The building HVACR building control system shall not control the fire alarm systems, security systems, lighting systems and elevator systems. These systems shall have independent control panels and network interfaces. The system shall be able to monitor the status of these systems in order to prompt emergency operating modes of building HVACR system.

The control system will use a high resolution GUI and provide view access to process control diagrams through a web browser that will show the component status, set points, condition status, and alarm status for each piece of equipment.

The control system device protocols and control software will provide the following control access functions:

- Data collection
- Data archiving
- Data trending
- Calendar scheduling
- Temperature based reset scheduling
- Programming of system functional set points

- Adjustment of set point range
- Automatic and manual control of addressable field devices
- Access to building systems flow diagrams, with navigation using GUI
- Energy management monitoring and curtailment
- Password reset
- Alarm level notification

The control system shall be design to use the available energy efficiently and to assist in troubleshooting the malfunction conditions of numerous addressable and non addressable controlled devices.

The control system design shall allow information retrieval at high speed so that any data can be retrieved within three seconds and trending within 30 seconds of the browser click at a remote station. The software will allow directing a critical alarm to a predetermined destination.

The control system will consist of sensors, controllers, microprocessors, routers and repeaters to be installed in each building and connected via Ethernet/intranet or other suitable high speed LAN to the central processing front-end workstation.

The control system shall be able to monitor building occupancy, individual area occupancy and time of day cycling of equipment. The ability for unauthorized adjustments shall not be allowed at addressable local devices.

The programming of the control system shall be performed from the facility operation center or via a web browser. Both require a password for access and the latter shall have firewall protection.

All non-proprietary energy management software and firmware shall be resident in field hardware and shall not be dependent on the operator's central control system terminal. Therefore, if the central control system fails, local control devices will continue to operate at the last control set point.

The system must include the ability to log data created by user selectable features. In new facilities and major renovations, the HVACR building control system shall have at least 25 percent spare memory capacity for future expansion

The use of modular design of the control system for maximum flexibility is encouraged.

The use of non-proprietary addressable field devices is preferred.

All new systems shall be native protocol neutral and no gateways shall be used for communication with controllers except for the existing controllers if required.

The design shall specify quality actuators that include a manufacturers warranty for five years for control applications on valves and dampers

Energy Conservation Design

The HVACR control algorithms shall include optimized start/stop for chillers, boilers, air handling units and all associated equipment and feed forward controls based on weather prediction programs as defined by the Energy Code.

The optimal start/stop programs calculate the earliest time systems can be shut down prior to the end of occupancy hours and the latest time systems can start up in the morning with the aim of minimizing equipment run time without letting space conditions drift outside comfort set points.

The weather prediction programs based on stored historic weather data in the hvacr building control system processor memory shall use this information to anticipate peaks or part load conditions.

The system economizer programs based on the site or regional environmental conditions shall be capable to operate the economizer cycles and heat recovery equipment in an efficient manner in accordance to the Energy Code.

The HVACR building control system shall include user programmable programs to monitor and control pumps, fans and compressors from operating equipment to stand-by modes on a scheduled basis.

14.2 CONTROL SYSTEM DELIVERABLES

The design document shall specify that the control system design submittals include process instrumentation diagrams, hardware submittal manual, software description manual, software test plan, acceptance test plan, functional point-to-point device testing,

operational manual, maintenance manuals, and spare parts list.

The software documentation shall include the specific sequence of operation including:

- Start/stop
- Night set back
- Optimum start
- Morning warm up/cool down
- Economizer cycle operation where applicable
- Energy reduction setback where applicable
- Static pressure control and or pressurization where applicable
- Smoke and or fire control where applicable
- Alarm requirements
- Alarm notifications
- Scheduling
- Trending intervals and limits
- Set points and or reset modes, where applicable
- Reset schedules

Energy Measurement Instrumentation

The HVACR building control system shall have the capability to perform automatic measurement of energy consumption and monitor performance.

Energy Management Data Collection Requirements

- Electrical values such as V, A, kW, KVAR, KVA, PF, kWh, KVARH, frequency and percent THD
- Mechanical values such as CHW flow and pressure, HW flow and pressure, equipment status and equipment capacity shall be monitored, measured and stored.
- The collection of data shall be maintained for trending for at least two years locally on the central HVACR Building Control System.
- Energy management measurements shall have the capability to totalized and trended in both instantaneous and time-based numbers for chillers, boilers, air-handling units, exhaust fans, and pumps.
- Energy monitoring data shall be automatically converted to user define standard database, transmitted to a designated interface PC and presented in a color spreadsheet format on demand.

Control System Design Features

- DDC drill down to zone level
- Intelligence at zone level "close loop" controls
- Cascading close loop for sequencing to minimize heating and cooling
- Control loop sequences for demand and energy efficient design
- Cascading control loop (valve control for heating)
- VAV zone cascading control (no overlapping of heating and cooling)
- AHU Controls (cascading set point reset per ASHRAE Standard 55 where applicable)

Demand Base Reset Control

- Supply temperature
- Supply pressure
- Building pressure
- Minimum outside air supply

Outside Air Control Methods

- Injection Fan, VFD controlled
- Accurate "DP" measurement across outside air damper assembly

CO2 Demand Control < 1,000 PPM at defined breathing zone

- Demands control ventilation for spaces less than 40 square feet per person in single zone and or greater than 300 square feet per zone (Assemblies and Conference spaces, etc.)
- Cascading control for CO2 (multiple zone sys-

tems)

DRAFT
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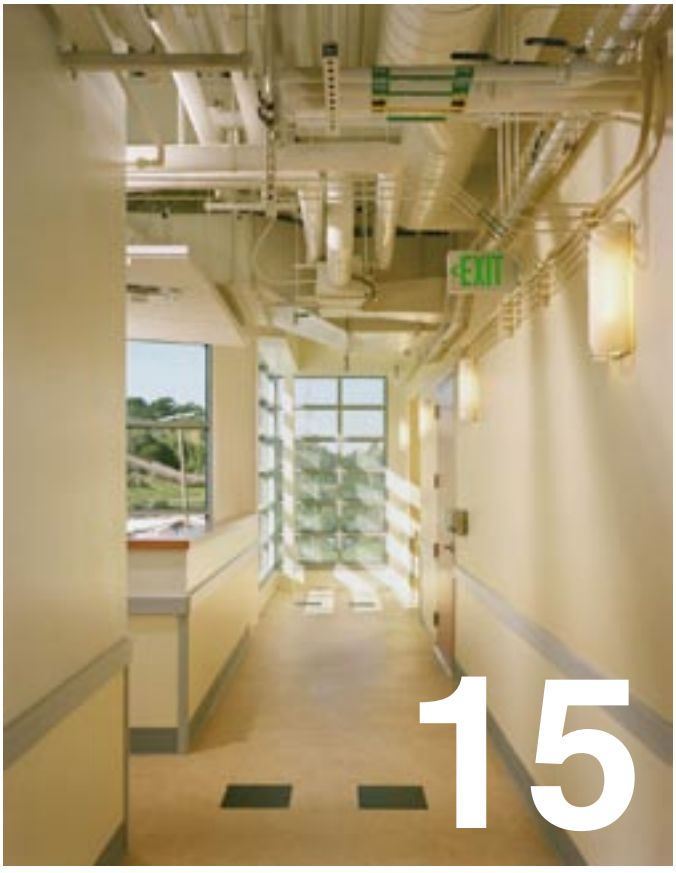

15

ELECTRICAL DESIGN CRITERIA

Exposed Utilities

unknown
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HOK Architects

15. ELECTRICAL DESIGN CRITERIA

This section defines the general and technical criteria for the building normal power system and emergency and standby power systems. It will encompass recommendations and minimum acceptable performance criteria for the normal power distribution system and the emergency and standby power systems.

15.1 OBJECTIVES

Designers shall use these criteria to develop building electrical power systems, standby electrical power system, including emergency generator and uninterruptible power system (UPS) design. The electrical system design shall provide a safe installation and operation of the electrical power supply and distribution through standardization of design, installation, and testing requirements, based upon sound engineering principles, applicable building codes, and field experience.

These criteria set the minimum acceptable requirements for design and installation of electrical power systems. While new technologies or alternate arrangements may be used, they shall not lower the level of safety prescribed by these criteria and the applicable state building codes.

Designers shall use the criteria to develop electrical power systems for new buildings, retrofit of existing buildings, or interior renovation of existing buildings. When the criteria are applied to interior renovations of existing structures, the designer shall provide systems that meet the design parameters of the existing power system and the requirements of these criteria, whichever result in a better system and also satisfy the applicable codes.

15.2 DESIGN CRITERIA

Basic Requirements

Spare capacity: All electrical panels, including the main building electrical service and emergency and standby power systems shall be adequately sized to power all the building, system needs and leaving not less than 15percent of the breaker positions spare for future growth. The spare positions shall be complete with full-length copper bus and hardware for future breaker installation. The designer shall demonstrate during the electrical system design that the required spare capacity has been preserved. The spare capacity shall be provided at each of the following system elements for future growth:

- Main building switchgear.
- Distribution bus risers.
- Distribution feeders and breakers.
- Space in electrical room layout for future addition of switchgear equipment and Motor Control Center (MCC) sections.
- Distribution and lighting panels.

The Distribution Transformers feeding the non-linear loads shall be K-rated to compensate for harmonics.

Full size neutral conductors shall be utilized throughout project for three-phase, four-wire service, power and lighting feeders. The neutral feeder on the secondary of Delta-Wye transformers shall be double size.

"True" RMS meters shall be used wherever meters are specified on switchgear and distribution boards.

In office areas, the ceiling space shall be used for the distribution of power, data, and communication systems. The distribution drops shall be contained in columns and walls to offices and workstation spines.

Power, voice, and data poles may be used on a case-by-case basis if approved by AOC.

The electrical equipment and systems shall be specified to include start-up, testing and adjusting per the applicable codes, recognized industry standards, and equipment system manufacturer requirements.

Switchboards, distribution panels, transformers, disconnects and branch circuit panelboards shall be of commercial grade and manufactured by one manufacturer throughout the building. All panelboards shall include door-in-door trim. All outdoor equipment enclosures shall be NEMA-3R or 4X depending on the application.

All electrical motors above ½ HP shall be 460 volts, 3-phase. This requirement shall be coordinated across the project with other disciplines.

Wiring devices: All power receptacles and switches for general purpose circuits shall be NEMA specification grade and manufactured by one manufacturer and rated for specific environment and application. Outlets served from an emergency power system shall be red. Outlets served from the normal power system shall be ivory.

All indoor floor-mounted equipment, MCC and panels shall be installed on minimum four-inch high concrete housekeeping pads. At outdoor locations, a minimum of six-inch housekeeping pads shall be provided.

The design criteria for the following systems shall be specified in accordance with the following Chapters:

- Chapter 4 (Courthouse Security)
- Chapter 13 (Mechanical Design Criteria)
- Chapter 16 (Lighting Design Criteria)
- Chapter 17 (Telecommunications and Audiovisual Design Criteria)
- Chapter 19 (Fire Protection Design Criteria)

For areas where high-speed computer and digital equipment are used in the building specify the following requirements:

- The neutral and ground conductors shall not be shared between phases A, B, and C. A separate neutral and ground conductor shall be specified for each phase feeding computer and electronic office equipment within buildings.
- For linear electrical power, specify phase, neutral and ground conductors to be one size larger than what is required by NEC.
- For three phase applications, specify double the size of the neutral conductor.
- The design shall include equal distribution of load on each phase.

Conductors

The following type of conductors shall be specified based on its application.

- All wire, cable and equipment shall be new.
- All wire #8 and larger shall be stranded copper. Wire used in fire alarm shall be solid copper per NEC.
- All wire and cable for secondary power distribution shall be 600 volt insulated, type THHN or THWN for #8 and smaller. Type THW, THHN and XHHW for #6 and larger and for wet, underground and exterior locations. Type RHH or THHN 90 degree centigrade standard used for fixture wire and circuit runs within fixtures.
- All wire #10 and smaller shall be color-coded throughout. The system conductors shall be identified as to phase connections by means of color-impregnated insulation or approved colored marking tape.
- Power and lighting branch circuits shall be specified not less than #12 wire gauge (AWG).
- Signal and control circuits shall be specified not less than #14 AWG.
- The cabling for fire alarm system, security system, telecommunication and audio visual systems shall be specified in accordance with the respective section requirements.
- Specify that the cable ducts for power is not shared with data and communication systems.

Conduits

The following shall be specified as a minimum requirement for the conduits:

- Minimum acceptable conduit size shall be .75-inch dia. Exceptions: Short runs to a single outlet or a single fixture may be .5-inch.
- For indoor locations where subject to physical damage: rigid steel or intermediate metallic conduit (IMC) with zinc coating inside and out with hot-dipped galvanizing and shall conform to ANSI C80.1 and UL. Couplings and unions shall be electroplated steel, threaded type.
- For interior space in dry locations: electrical metallic tubing (EMT), cold-rolled steel tubing, with enamel coating inside and zinc coating outside and galvanized steel fittings.
- For electrical service and underground distribution: PVC coated galvanized rigid steel, concrete encased.
- In wet and outdoors locations specify cadmium plated cast malleable iron liquid-tight fittings with insulated throat.
- Flexible metallic conduits of limited lengths may be used at power terminations to equipment in indoor and dry locations. For outdoor and wet locations, it shall be liquid-tight with plastic jacket extruded over the outer zinc coating.

Quality Assurance

All materials, devices and equipment shall be commercial grade, new and Underwriters Laboratories (U.L.) listed.

The electrical system design shall be in conformance the applicable codes and standards and the requirements of this criteria.

Certain material, equipment, apparatus or other products may be specified by manufacturer's brand name, type or catalog number. In such case the designated product shall meet the established standards for quality, style, utility, and performance.

The main switchboard, distribution panels, transformers, disconnects, and branch circuit panelboards shall be manufactured by a recognized manufacturer with minimum 10 years experience in the manufacture of such equipment and shall be manufactured to commercial grade specifications.

Identification

Electrical system shall be specified to include identification and signage in accordance with ANSI Standards. Specify identification at each power service switch boards, power distribution panels, transformers, conduits, branch circuits, pull boxes, outlet covers, and J-boxes using industry standard materials and methods.

Electrical light fixtures and convenience outlets on emergency power circuits shall be identified with a unique identification system. The identification tag shall be applied at location, which is easily identifiable and uniformly applied throughout the building.

Coordination

The electrical work shall be coordinated with the work of all other divisions to interface power and control requirements to equipments, devices, lighting, control systems and other systems specified under the respective divisions.

Power Distribution System

For new facilities, the power service will be taken from the 277/480V 3 PH 4W distribution system via transformers in a transformer vault or on a pad. The location of the transformer shall be properly coordinated with the local utility company, depending on the project location. The designer shall coordinate with the utility company on proper sizing of the service to ensure there is 15percent spare capacity available for future growth.

Branch circuit panelboards will be located throughout the facility. 277/480V panels will be fed from breakers in the main switchboard. K13 (harmonics rated) dry-type step-down transformers will be provided, which will in turn feed 120/208V 3 PH 4W distribution type panelboards or via distribution panels. 120/208V branch panelboards located throughout the facility will be fed from breakers in these distribution panels.

Large air conditioning and motor loads will be supplied at 480 volts 3 PH from the new main switchboards and distribution boards.

Lighting fixtures will be connected to 20A1P circuit

breakers in 277/480V 3 PH 4W branch circuit panelboards.

Convenience and special power receptacles will be provided as required throughout the facility. Convenience receptacle and miscellaneous loads will be connected to 120/208V 3 PH 4W branch circuit panelboards.

Computer and other sensitive electronic loads will be fed through point-of-use, localized UPS units as required.

Neutral bussing and conductors for all distribution equipment feeding clean power panelboards and branch circuiting will be sized to accommodate harmonic currents generated by electronic power supplies.

A TVSS (Transient Voltage Surge Suppressor) will be provided either at the main switchboard or at distribution boards. The TVSS will comply with UL 1449. TVSS units will also be provided at the clean power 120/208-volt panelboards throughout the building.

Grounding System

Complete grounding system shall be provided per the National Electric Code (NEC). The electrical system shall be grounded to a common building grounding system, which utilize grounding to building steel, building cold water pipe and concrete encased electrode. Grounding to cold water pipes shall only be to continuous metallic main pipe. Where the cold water pipe has insulated joints or plastic pipe connectors, properly sized jumper cables shall be specified to maintain the continuity of the pipe grounding.

The grounding system for the transformer shall be provided per the local utility company criteria. The building emergency generator shall be grounded to provide 200 percent of the nominal capacity required. Telecommunications equipment rooms shall be grounded per the requirement of Chapter 17 (Telecommunications and Audiovisual Design Criteria). For existing buildings, the grounding shall tie back to the nearest building grounding and to the building steel and building cold water pipes.

15.3 EMERGENCY AND STANDBY POWER SYSTEM

General Requirements

The capacity of the emergency power system shall be carefully evaluated, based on the project size, location and usage. The fuel storage capacity shall be based on the minimum requirements to provide life safety and egress lighting. In remote project areas with limited accessibility, or if the court building will serve as an emergency operations center, the generator size and fuel storage capacity may be designed to meet local requirements, based on discussions with the AOC project manager.

Specify engine mounted critical type exhaust muffler and double contained integral type fuel oil day tank with fuel leak detection system.

- The automatic emergency power system shall consist of a 277/480V, 3 Ph, 4W diesel engine generator set, water-cooled radiator type, 1,800 rpm, complete with integral base-mounted day tank. Engine generator set shall be located indoors or on the roof or on the site with weatherproof-sound attenuating enclosure.
- A single electrical operator shall operate the transfer switch, with bypass/isolation in normal and emergency positions.
- Fuel oil storage tank may be above or below grade, with proper filling and monitoring systems. The day tank shall be of the manufacturer's standard size, based on the generator capacity.
- In buildings equipped with emergency power, the following areas in the building shall have emergency lighting on generator power as a minimum:
  - Detention areas, custody areas, and sally port.
  - Exit signs.
  - Exit corridors.
  - Egress lighting for public corridors and stairwells.
  - Assembly rooms, such as courtrooms.
  - Communication equipment rooms.
  - Generator, electrical, mechanical and elevator equipment rooms.
  - Security control offices.

Systems where outage of 10 seconds (to transfer from normal to emergency power) could damage essential equipment or impair safety shall be on UPS power connected to generator power. The areas shall include, but are not limited, to the following:

- Security control center, main & secondary equipment, including cameras and communication systems.
- Computer servers.
- Telephone switch.

The following systems shall have emergency power:

- Air conditioning units serving the communications equipment rooms, elevator machine rooms and computer equipment rooms.
- Back-up ventilation fans serving the aforementioned rooms.
- Any alarm and security system, including CCTV and communications system.
- Sprinkler system alarming devices and fire alarm systems.
- Computer equipment system, via UPS.
- Data communications equipment (on a case-by-case basis).
- Fire life safety system.
- All parts of electrically operated detention systems, such as gates and lockup doors.
- Two elevators; one public, one secure or private (on a case-by-case basis).
- At least one emergency duplex convenience receptacle in electrical, mechanical, telecommunication, audiovisual and elevator equipment rooms.

Uninterruptible Power System (UPS)

UPS shall be small localized and rack mounted units to serve individual racks or equipment. In larger facility central UPS may be provided if necessary.

UPS for the data processing equipment shall consist of shielded isolation transformers, rectifier/battery charger, solid-state inverter, static bypass transfer switch, maintenance-free batteries for 15 minutes, and synchronized circuitry.

Specify grounding mat and water detection in the computer room.

UPS system shall include load bank for testing.

The UPS system shall include distribution panels, for a complete hook-up to the operating equipment.

Installation Contractor Certification

The electrical system specifications shall require the installing contractor to certify that the work is installed in accordance with the applicable codes and standards. The system shall be tested, adjusted, fully functional, and all necessary inspections and certificates of occupancy shall be obtained.

Energy Management System Interface

Coordinate with the building Energy Management System (EMS) division work to control, monitor, alarm, and data log the following electrical power information as a minimum:

- Building normal and emergency power consumption and demand.
- Emergency generator alarms, including but not limited to engine trouble, low fuel, fuel leak alarm, low voltage, and loss of phase.
- Lighting controls, including interior lighting, lighting on emergency power, and exterior lighting.

DRAFT
August 3, 2005

16

LIGHTING DESIGN CRITERIA

Public Waiting Area

Phoenix Municipal Courthouse
Phoenix AZ
HOK Architects and DMJM Architects

16. LIGHTING DESIGN CRITERIA

This chapter defines the general and technical criteria for lighting, and encompasses recommendations for best practices, energy efficiency, sustainability, and creating productive work environments that emphasize the dignity and importance of activities conducted in the facility.

16.1 OBJECTIVES

Lighting design in the court facility shall be functional, appropriate for users, energy efficient, easy to maintain, and maximize use of appropriate technology. Daylight in occupied spaces is desirable, but must be carefully controlled to avoid glare, minimize heat gain, and in some security sensitive spaces, minimize views into the space from outside the building.

Designers may use a variety of methods to illustrate design concepts, such as computer simulations, calculations, renderings, models, and mock-ups. Mock-ups are encouraged when a project has the same or similar spaces repeated throughout the facility, such as courtrooms. Custom light fixtures shall be discouraged, except in architecturally significant spaces where they are deemed necessary to advance the design concept.

16.2 DESIGN CRITERIA AND PERFORMANCE GOALS

Refer to Table 16.1 (Recommended Illuminance Levels) for recommended illuminance levels.

Reflectance Values

Indirect or direct/indirect lighting systems shall be the preferred system. The reflectance of surrounding surfaces greatly impacts the quality of the lighting system, and energy efficiency levels. Surrounding surfaces shall comply with criteria noted in Table 16.2 (Recommended Reflectance Levels).

Lamp Selection

- Interior lighting systems shall be primarily fluorescent, with some metal halide lamps, to maximize energy efficiency and minimize maintenance.
- LED systems may be considered as the technology improves.
- Induction sources may be considered where relamping is difficult because of high ceilings or fixed furniture.
- Minimize the number of lamp types wherever possible, for ease of maintenance.
- Select long life sources to minimize replacement and landfill contributions.
- Limit incandescent (including tungsten halogen or quartz) lamps to artwork and displays, or for detailed facial recognition in some areas.
- Utilize the most energy efficient light sources with the lowest mercury content, to maximize energy efficiency and sustainability.
- Within a facility one type of four foot fluorescent lamp and two types of compact fluorescent (single ended) lamps shall provide most of the building lighting.
- All fluorescent lamps and metal halide lamps under 150 watts will use electronic ballasts. Fluorescent lamps will be tri-phosphor (80+ CRI) and 3500K. Metal halide lamps will be 80+ CRI and 3000K.
- For exterior lighting, use white light sources with a high CRI, such as metal halide and induction sources. Where low temperatures are not common, fluorescent lighting shall be considered.

Space Description	Recommended Illumination Level (fc) [1]	Other Considerations
Courtrooms		
Judge's Bench	45-55	Additional task lighting may be desirable from ceiling
Clerk	45-55	Additional task lighting may be desirable from ceiling
Spectator Seating	15-25	
Litigant's Table	45-55	Additional task lighting may be desirable from ceiling
Podium	45-55	Additional adjustable task lighting recommended
Witness Chair	30-40	
Offices		
Intensive VDT[2] use	30-40	Additional task lighting may be desirable
Intermittent VDT use	45-55	Additional task lighting may be desirable
Conference Rooms	30-40	
Circulation	15-20	
Public Lobbies	15-20	
Holding Areas	25-35	
Library		
Active Book Stacks	25-35	Vertical illumination to within 30 inches of the floor
Reading Areas	30-40	Task lights in some areas are desirable
Holding Areas	25-35	
Restrooms	10-20	

1) Value ranges are for general illumination unless noted otherwise. Task illumination requirements are higher.
2) Visual Display Terminal (VDT)

Table 15.1 Recommended Illuminance Levels

Ceilings	Minimum reflectance shall not be below 85%
Walls, systems furniture partitions	Generally walls should not be below 50% reflective but occasional accent walls that are darker will be acceptable
Floors	Approximately 20percent reflective

Table 15.2 Recommended Reflectance Levels

High and low pressure sodium and mercury vapor shall not be used.

- For public art or other displays, the type of art, and location shall be identified during design development, to ensure adequate, appropriate lighting.

Fixture Selection

Lighting fixtures shall be selected on the basis of a maintaining a 20-year life cycle with the facility. Fixtures shall be evaluated on the basis of effectiveness, long term life cycle costs, especially characteristics and components that ensure longevity and quality, not only lowest first costs.

Visual Criteria

Fixtures shall be selected and located to minimize direct or reflected glare. When several fixtures are specified as equally acceptable, the specifier shall ensure that they meet equivalent performance standards.

Energy Efficiency Criteria

Efficient light sources can be optimized with fixtures that are designed for specific light sources, further enhancing system efficiency. The most efficient fixtures that provide visual comfort necessary for the activity shall be used.

Maintenance Criteria

Typically, most facility management departments have limited resources, and a maintenance staff with little to no training in relamping methods.

- Access to fixtures for relamping shall be readily apparent.
- Removable shielding devices shall have cables or chains to hold the device to the fixture during relamping.
- Reduce relamping errors by minimizing the number of lamp types within the facility and using lamps with sockets that are unique from each other.
- A color-coded relamping diagram, provided by the design team at the end of construction, will assist the maintenance staff.

16.3 LIGHTING STRATEGIES

The following recommendations address various spaces in and around the facility.

Exterior Lighting

Exterior lighting provides safety and security for those entering and exiting the building outside of daylight hours, and enhances the building's civic presence within the community. As a design element, exterior lighting can highlight the architectural elements and character of the building, while controlling glare.

Exterior lighting shall be compatible with security cameras used on the site. Typically, a high uniformity ratio, of 3:1 or 4:1, shall be used, with well-shielded fixtures. Lighting levels do not need to be high if the light source is of good color quality, uniformity is high and glare is minimized. Lighting levels shall be determined for each project, based on camera technology and local site requirements.

Exterior lighting shall not contribute to light pollution, either by throwing light beyond the property, causing glare and unwanted light for neighbors, or up into the sky, contributing to sky glow and obscuring nighttime vistas. USGBC's LEED for New Construction Version 2.2 (Site Credit 8) shall be used as a guideline for developing the exterior lighting plan.

Outdoor lighting shall have photo sensors for control.

Courtroom Lighting

Facial feature modeling is very important in the courtroom, except the spectator area.

- Use a combination of direct and indirect lighting.
- Avoid harsh shadows, whether from electric light or daylight.
- Minimize direct and reflected glare.
- Ensure fixture quality and appearance reflect the dignity of courtroom activities.
- Avoid trendy looks; durable, aesthetic choices are best.

Audiovideo presentations are common in many courtrooms. Projectors and screens are often portable, so lighting must be flexible enough to allow for dimmed ambient light levels, with sufficient light for note taking. For courtrooms with flat screen monitors

located in the jury box, ensure light sources do not obscure the screen image. Provide multiple levels of switched controls or continuous dimming in all courtrooms.

Diffuse daylight, without direct sunlight penetration, is desirable, but will not be possible in all spaces. Where daylight is available, provide shading devices capable of darkening, but not blacking out the room. In spaces where a direct view into the courtroom is a security concern, provide daylight by clerestories or skylights. Where daylight is unavailable, supplement general illumination with other wall lighting such as wallwashers, or sconces.

General Open and Private Offices Lighting

Office ceilings shall be suitable for indirect or direct and indirect lighting. As with other spaces, minimizing glare and maximizing fixture efficiency are key considerations. Where the energy code requires additional controls for daylight zones, dimming is preferred to multi-level switching or stepped dimming.

Judges Chambers Lighting

The judge's chambers have the same general illumination requirements as other offices. The chambers typically have several task areas. Provide supplementary task lighting as follows:

- Bookshelf wall washers sufficient to light the books from the top shelf to the bottom. Requirements are similar to library stacks.

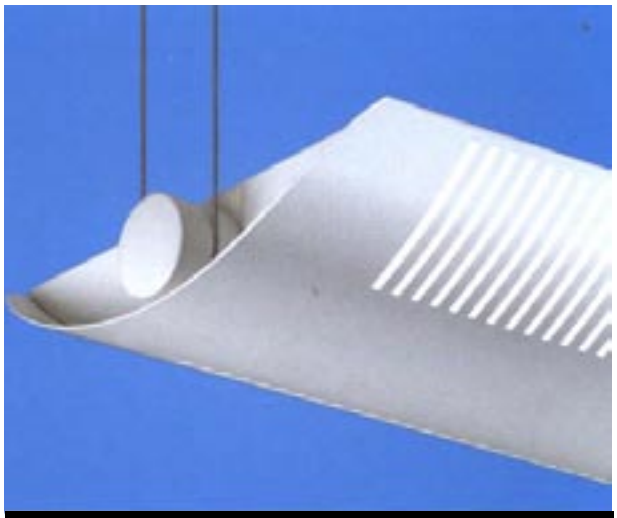

Figure 16.1 Direct/Indirect lighting Fixture

- Overhead task lighting at the conference table.

Lobby Lighting

Lobby shape, size, finishes and lamp types vary at each facility. Lighting shall complement the materials and architectural features, through the use of downlights, wallwashers, cove lights, and decorative fixtures. Select the most efficient source with good shielding to reduce glare. Public art in the lobby shall be identified during early design phases so that appropriate lighting can be specified.

Circulation Lighting

Circulation areas shall have even, diffuse illumination for wayfinding. Fixture selection and location shall be coordinated with directional signage and artwork. Limited accent lighting may be used to assist in wayfinding.

Holding Area Lighting

Select security rated lighting fixtures for these areas.

Library Lighting

Each row of book stacks shall have illumination from fixtures designed to provide good vertical illumination in a narrow space. Fixtures can be mounted to the ceiling or the stack, depending on the specific project conditions.

Transaction Counter Lighting

A glass or acrylic security barrier typically separates the public from staff in areas where public transactions occur. This barrier can create reflections from light fixtures that reduce visibility, and the ability to view facial expressions. Reflections cannot be eliminated, but they can be minimized by limiting light output to horizontal work surfaces and using fixtures with a low surface brightness. A glass or acrylic barrier that is intersected by an 18-inch or greater soffit at the ceiling will reduce reflections. Lighting layouts that are identical on both sides of the glazed material will minimize reflections. Indirect or direct/indirect lighting shall be avoided under these conditions, as the bright ceiling will be a source of reflected glare in the glazing.

Restroom Lighting

Lighting at mirrors shall be adequate to see without creating facial shadows. Lighting shall be evenly

distributed within the stall areas. Light color value wall surfaces are preferred over darker values.

Service Area Lighting

Lighting for electrical and mechanical rooms, janitor closets, and related areas shall consist of fluorescent striplights and wireguards.

Below Grade Vehicle Area Lighting

At judges' parking, loading, receiving, and central holding areas, uniform lighting without shadows shall provide visibility and coverage if security cameras are used. Metal halide and induction sources shall be considered for these areas, along with fluorescent, where temperature is not a concern. Fluorescent and induction sources are preferred where on and off cycles are frequent, or where emergency lighting is required.

16.4 LIGHTING CONTROLS

Building controls shall comply with California Code of Regulations: Title 24, Building Codes requirements.

Courtrooms typically have multiple zones of control. Utilize the least complex, most intuitive system that will provide the required functions. In courtrooms with four or fewer zones of control where lighting can be controlled from one primary location with one or two additional three-way controls, standard wallbox switches and dimmers shall be used. In courtrooms with more than four zones of control or multiple control location requirements, or if a room can be sub-divided into smaller rooms with movable partitions, provide a preset dimming system. Controls shall be located to be convenient to court staff but not accessible to the public.

16.5 LIGHTING COMMISSIONING

Specifications shall include commissioning services to ensure the building delivered at the end of construction has fully operational occupancy sensors, photo cells, and dimming systems that provide proper controls. Basic services shall include staff training for systems operation and troubleshooting.

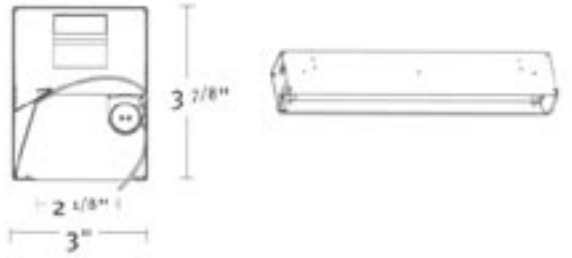

Figure 16.2 Wallwasher Fixture

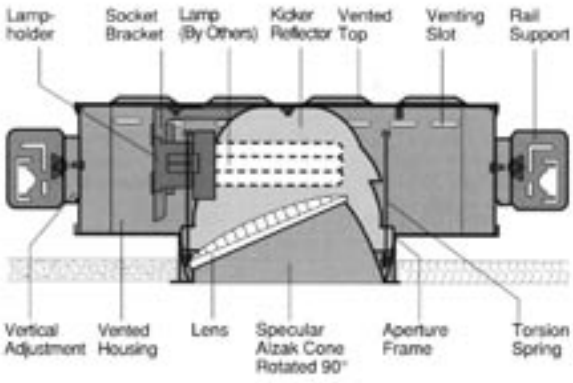

Figure 16.3 Wallwasher Fixture

Figure 16.4 Tasklight

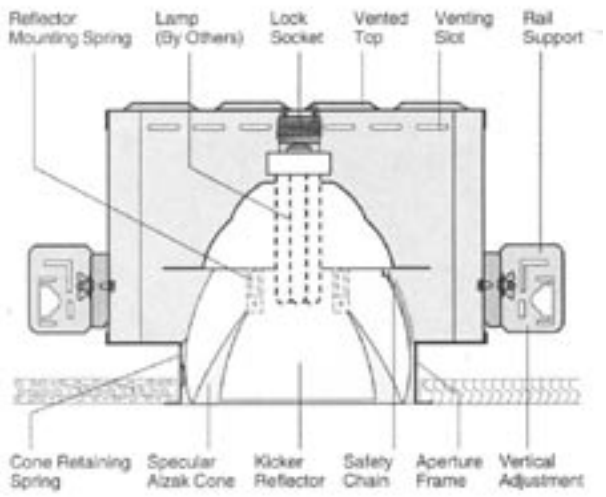

Figure 16.5 Downlight

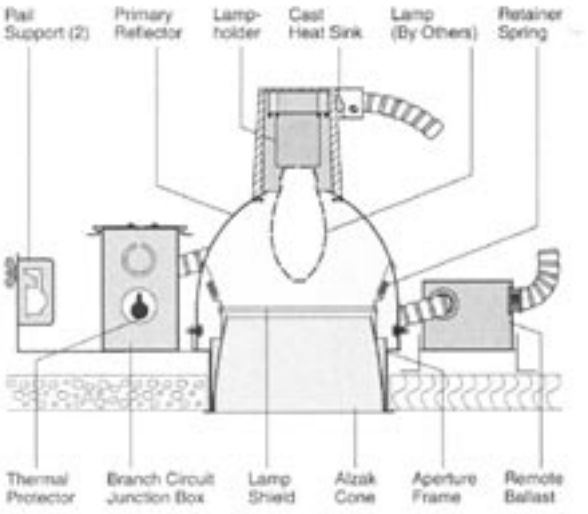

Figure 16.7 Downlight

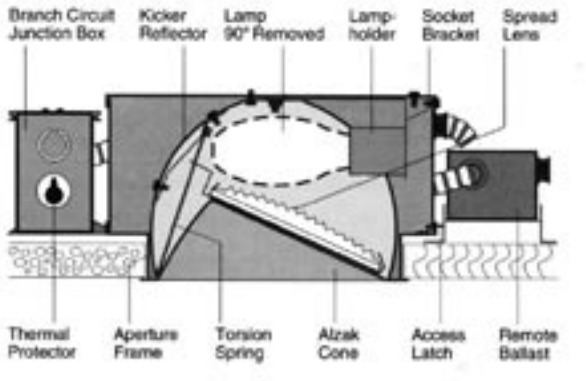

Figure 16.6 Wallwasher

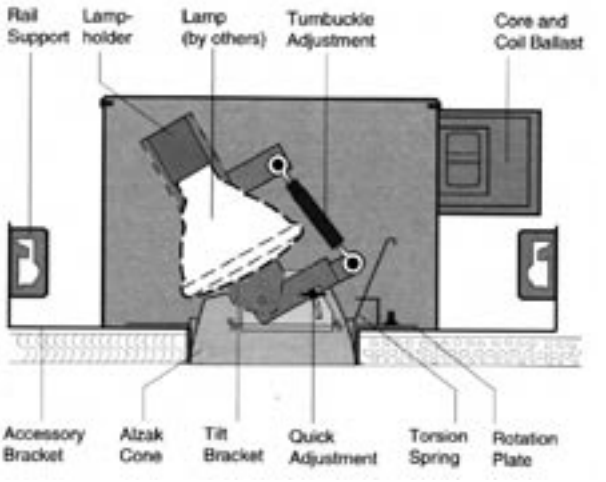

Figure 16.8 Accent Light

Figure 16.9 Library Stack Lighting

Figure 16.10 Low Brightness Direct Luminaire

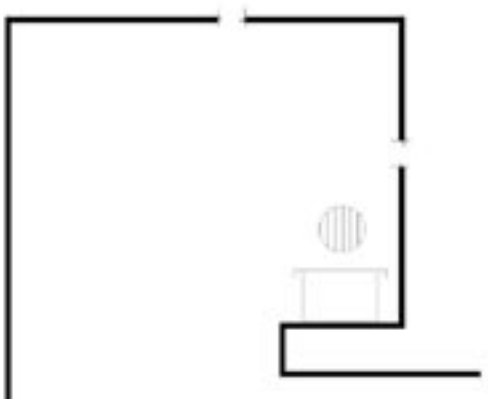

Figure 16.11 Cove for Restrooms

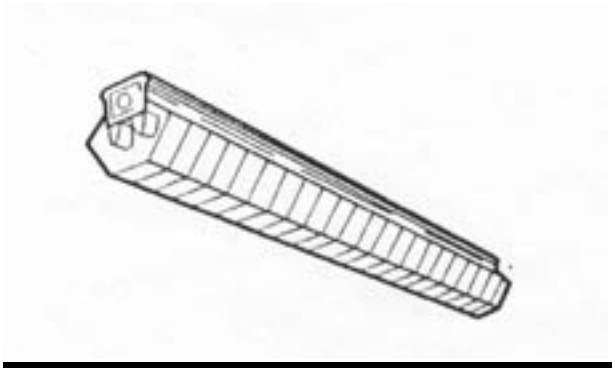

Figure 16.13 Striplight with Wireguard

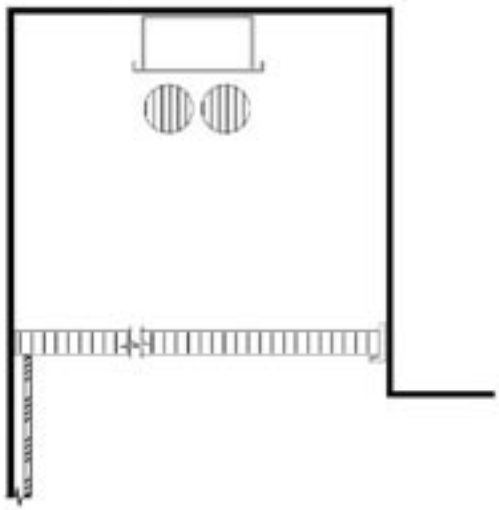

Figure 16.12 Cove for Restrooms

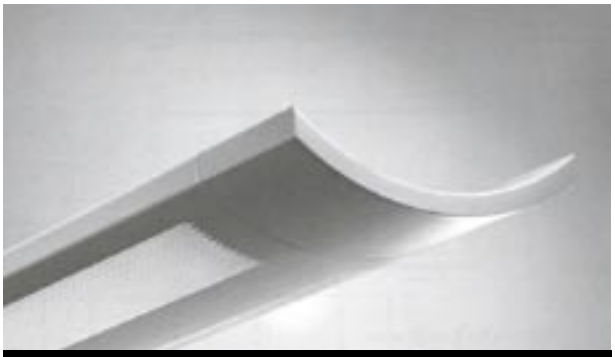

Figure 16.14 Direct/Indirect lighting Fixture

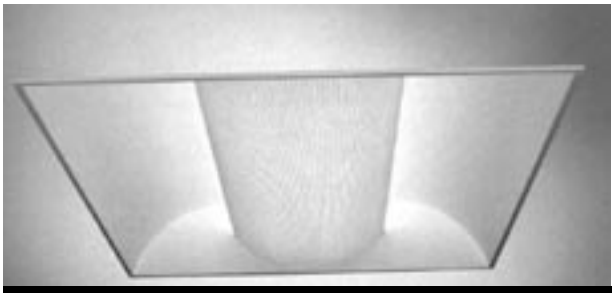

Figure 16.15 Circulation General Illumination

DRAFT
August 3, 2005

17

TELECOMMUNICATIONS AND AUDIOVISUAL DESIGN CRITERIA

Electronic Lectern
Location Unknown

17. COURT TECHNOLOGY

Telecommunications and audiovisual systems are essential for daily courthouse operations. A technology program is required with the architectural program; the design consultants, OCCM and the Court Advisory team shall determine what is to be provided throughout the court building. The technology program shall be predicated on the personnel available or required to support the technology; the extent and complexity of telecommunications and audiovisual technology to be embedded in a new court building will be determined in part by the commitment of the Court to provide the required operational support. This chapter describes industry standards, best practices, design criteria, performance criteria, and requirements for telecommunications and audiovisual technology. Telecommunications and audiovisual system design shall be coordinated to avoid duplications and conflicts.

17.1 TELECOMMUNICATIONS

Telecommunications systems require dedicated spaces, pathways, cabling, and grounding to support voice and data communications throughout the courthouse.

17.2 TELECOMMUNICATIONS OBJECTIVES

This chapter describes the technical standards and design criteria for court telecommunications systems. Building infrastructure must support installation of the telecommunications system, at initial occupancy and in the future, with spaces, pathways, work areas, cabling, grounding and bonding, administration, and performance verification.

17.3 TELECOMMUNICATIONS DESIGN CRITERIA

The items identified below clarify and enhance industry standards. These standards shall be the minimums applied during facility design. Where clarifications are identified, provide the systems, components, and facilities described.

Telecommunications Spaces

- Equipment Room:

  Minimum size of Equipment Rooms shall be 150 square feet for buildings up to 20,000 square feet. Add 0.75 square foot to the Equipment Room for each additional 100 square feet over 20,000 square feet. If audiovisual and broadband distribution equipment is to be housed in the Equipment Room, add 25 square feet for each audiovisual equipment rack. Comply with the sizing and location requirements identified in ANSI/TIA/EIA-569.

  Limit access to equipment rooms to those persons performing necessary work in that area. In sensitive or critical equipment rooms, allow a two to four week out-gassing period after completion of construction before the installation of network electronic equipment.

- Telecommunications Room:

  Telecommunications Rooms shall be nine-feet wide by 10-feet long (minimum) for each 10,000 net square feet (NSF) served. Provide an additional Telecommunications Room if the area exceeds 10,000 square feet. These requirements may be on a case-by-case basis, and will require telecommunications rooms serving more than 10,000 NSF to be increased in size to accommodate the area served.

- Telecommunications Space Pathways, Racks, Frames and Cabinets:

Provide a design for telecommunications spaces to create a continuous cable runway from all pathways entering the telecommunications space to all equipment racks, frames, and cabinets. Use horizontally and vertically mounted cable runway from the entrance pathways to the equipment racks, frames, and cabinets.

Provide EIA RS-310-C compliant 19-inch equipment racks in the telecommunications spaces for mounting of fiber optic cable and copper horizontal cabling. Provide one rack for each 240 horizontal cables terminating at patch panels. Provide for 50 percent growth capacity. Each rack shall be equipped with one vertical cable manager on each side of the rack with a minimum six-inch width. Provide horizontal cable management to accommodate the quantity of cables terminated, including patch cables.

Minimum clearance from the front and rear face of racks to the nearest obstruction must exceed 36-inches. Wall-mounted termination and protection blocks are considered an obstruction.

Power distribution at the equipment racks will require a minimum of 12 outlets on power strips.

Standard cabinets in equipment rooms are 24-inches wide by 36-inches deep by 84-inches high, nominal. Cabinets are four-post style.

Place cabinets in aisles with the front of the cabinets facing each other, and the rear of the cabinets facing each other. Do not face the front of a cabinet facing the rear of the another cabinet. Minimum clearance from the front and rear face of cabinets to the nearest obstruction must exceed 42-inches. Preferred clearance is 48-inches.

- Horizontal Pathways:

The preferred method for routing cables from the telecommunications room to the outlet is cable tray and conduit.

Cable trays shall be used to support major runs of cables in accessible locations, such as above acoustical tile ceilings. Use ladder or spine type trays. Place trays at the lowest possible position to provide future accessibility. Cabling will be the most frequently changed component in ceiling areas and must be accessible. Provide 24-inch clear access to one side of the cable tray, and 12-inch clear access at the top of the tray. Where the cable tray provides shared service for low voltage cables (security, network, audiovisual, or building management systems cables), provide divided cable trays with each divided section of sufficient size to support the cables to be installed.

J-hooks may be considered for use where the quantity of cables is less than 50, and where the cables are completely concealed for the entire run. Provide j-hooks on 48-inch centers, minimum. Use of j-hooks are not preferred and should be avoided if possible.

Provide dedicated conduit from the cable tray to the telecommunications outlet box to allow for future placement and maintenance of cables. Do not 'daisy chain' telecommunications outlet boxes together with conduit. No conduit shall serve more than one telecommunication outlet box, with the exception of feeds into the spine of modular workstations. As a cost reducing measure, cables may be, without conduit, using j-hooks and the stud cavities as pathways. Where conduit is not used, take steps to protect the cables as it passes into the stud cavity and into the telecommunications outlet box, such as placing protective bushings or grommets at openings where the cables may become damaged.

Minimum size of conduit serving a telecommunications outlet box shall be one-inch, except at modular systems furniture outlets. At modular systems furniture outlets, where cast-in-place conduit is terminated at floor boxes and routes to the modular furniture, conduits may be filled to the maximum allowable by code, or as allowed by the floor box manufacturer, which ever is less.

The minimum outlet box size is four-inches by four-inches by two-inches deep. Provide single

BGSF served	Quantitiy of four-inch conduits to BEF
Up to 20,000	3
20,000 to 60,000	4
60,000 to 100,000	5
100,000 to 200,000	6
200,000 +	verify with program

Table 17.1 Entrance Conduit Requirements

or double-gang device ring to accommodate the telecommunications faceplate. Larger boxes are required for larger conduit, in accordance with the standards.

- Use of power poles in the design of telecommunications facilities should be avoided. Entrance pathway and sizing: Use buried pathways using conduit. Based entrance pathway sizing on the specific user requirements. Provide a minimum quantity of four-inch conduits based on building gross square feet (BGSF). Refer to Table 17.2 for the quantity of conduits required based on building size.

  For a facility larger than 200,000 BGSF, the requirements will be project specific, and conduit quantities must be confirmed. If the project contains more than one building, each building may have the quantity of entrance conduits shown above.

- Entrance Pathway Vaults and Maintenance Holes: Entrance and exits from the vaults and maintenance holes are to be from the ends only. Do not use the vaults and maintenance holes to make directional changes.

  Vaults and maintenance holes shall be provided with embedded racking and cable hooks for cable and attachment management, sump hole, cast-in-place pulling irons, and cast-in-place bonding grid for telecommunications use. Vault and maintenance hole covers shall meet the expected traffic conditions for the proposed location of the vaults and maintenance holes.

- Entrance Pathway Innerduct: Provide four, one-inch PVC innerduct in ducts as indicated in the schedule below:

- Entrance Pathway Duct Sealing: Provide duct sealing plugs at each duct and innerduct installed in the entrance pathway. Plugs are required whether the duct is occupied or empty. Duct sealing plugs at building entries shall be provided with drain cocks to allow water to be drained prior to opening the duct-sealing plug.

Quantity of four inch conduits in duct bank	Number of four inch ducts with four one-inch innerduct
3	1
4	2
5	2
6	3

Table 17.2 Entrance Innerduct Requirements

- Roof Entrance Pathways: Provide a minimum of two two-inch metallic conduit pathways from the roof to the equipment room for routing of satellite and other communications cables. Locate the pathways adjacent to the locations for communications reception equipment on the room. Provide 'weather head' service entrances for the roof entrance pathways.

Cabling

- The required multimode fiber optic cable is:

  Core: 50/125

  Bandwidth: 700/500 MHz-km (850/1300 nm)

  Attenuation: 3.5/1.5 dB/km

  Gigabit Ethernet Distance: 750 meters

  10 gig Ethernet distance: 150 meters

- The required single mode fiber optic cable is:

  Core: 8 micron (nominal)

  Attenuation: 1.0/0.75 dB/km (1310/1550 nm)

  Gigabit Ethernet Distance: 5,000 m

  10 gig Ethernet distance: 10,000/40,000 m.

  Use ANSI/TIA/EIA 568 SC-type connectors for fiber optic connectors.

  Terminate fiber optic cabling in fully enclosed fiber optic patch panel. Provide 50 percent spare capacity at the panel.

  Fiber optic cabling shall form a hierarchical star originating in the equipment room. Each equipment room, telecommunications closet, and building entrance facility shall be connected to the main distribution frame using a minimum six-strands of singlemode fiber and 12-strands of multimode fiber. If the singlemode and multimode terminate at different fiber optic patch panels,

provide the singlemode and multimode in different physical jackets

The type and quantity of fiber optic cable is court dependant, and will change over time. The design professional shall verify that quantities and types of fiber optic cable meet the needs of each court and court project.

- Copper Backbone Cabling

  Copper backbone cable shall be terminated on 110-type blocks mounted to metallic enclosures mounted to the plywood backboard. Terminations shall use C-5-type clips.

  Cabling type shall be dependant on the space in which the cables will be placed. In non-plenum spaces, use CMR rated ARMM-type backbone cable. In plenum spaces, use CMP copper backbone cables.

  Pair count for copper backbone cable shall be based on the number of work areas served. Refer to this page for the required pair count schedule.

  The design professional must verify with the telephone service provider for voice services if copper protection is provided by the Court or by the service provider. Show locations for protection devices on the drawings, whether provided by the Court or the service provider.

- Backbone Copper Coaxial Cabling

  For distribution of broadband television signals between telecommunications rooms, use quad shielded Series 11 coaxial cabling that meets or exceeds the Society of Cable Television Engineers guidelines for construction and attenuation.

  Backbone coaxial cables will be provided with a black jacket.

  Design the coaxial cabling system in a star topology. Homerun cables from telecom rooms to the broadband television distribution headend.

  Terminate coaxial cables at directional couplers, splitters or tap-offs in the telecommunications rooms or spaces.

- Copper Horizontal Cabling

  Copper Cable Types and Permanent Link: Provide the design based on the highest approved performance standards level for unshielded twisted pair cabling (UTP), based on ANSI/TIA/EIA cabling standards current at the time of bidding. Minimum standard for all components in the permanent link are Category 6.

  Cables for data outlets will be provided with a blue jacket; cables for voice will be provided with a white jacket.

  Terminate data cables on 19-inch patch panels in the telecommunications rooms. Provide one horizontal cable manager for each patch panel provided.

  Terminate voice cables on 110-type termination blocks using C-4 clips.

  Wiring standard for Courts is TIA/EIA 568A.

- Horizontal Copper Coaxial Cabling

  For distribution of broadband television signals to televisions and end stations, use quad shielded Series 6 coaxial cabling that meets or exceeds the Society of Cable Television Engineers guidelines for construction and attenuation.

  Coaxial cables will be provided with a black jacket.

Work Areas Served	Pair count of copper backbone cable
1-25	50
25-60	100
60-125	200
125-200	300
200-300	400
300-500	600
500-800	900
Above 800	1.5 pairs in backbone cable for each work area served.

Table 17.3 Copper Backbone Requirements

Design the coaxial cabling system in a star topology. Route coaxial cables to the telecommunication room or space to which the data and voice cable is routed.

Terminate coaxial cables at directional couplers, splitters or tap-offs in the telecommunications room or space.

At the work area or end station, terminate the cable on an 'F' type connector. Provide an "F" barrel insert for the telecommunications faceplate that serves the location, if available. Provide separate faceplate if no telecommunications faceplate is available.

- Wireless Local Network (WLAN)

  If a WLAN is included in a project, the courthouse shall be provided with cabling and outlet locations to fully cover all designated locations with wireless local area network(s) with a minimum signal to provide a nominal throughput of 5.5 megabits per second, or one quarter of the bandwidth of the access point, which ever is greater. WLAN outlets shall be provided in unobtrusive locations that prevent tampering and vandalism. Do not place WLAN outlets in air return plenums.

  Assume that 120 VAC electrical outlet will be required at each WLAN outlet location to power access points. Do not assume use of Power over Ethernet (PoE) without verification.

Telecommunications Outlets and Connectors

The standard outlet for the courts consists of two data and two voice telecommunications outlet and connectors at a single gang faceplate. Data outlets shall be blue. Voice outlets shall be white. Refer to Table 17.4, types of outlets in typical rooms.

Test the entire cable plant using industry recognized testing procedures. Provide written test results for each cable and fiber optic strand installed. Test results will be reviewed for conformance with the testing standards.

Test horizontal copper cable for the following parameters:

- Frequency Range
- Propagation Delay 546 ns @ 250 MHz
- Delay Skew
- Insertion Loss
- NEXT
- PSNEXT

Outlet Type No.	Description
1 Standard	two data and two voice at single gang faceplate
2	three data and one voice at single gang faceplate
3	four data at single gang faceplate
4	one data & one voice at single gang faceplate
5 WLAN	one data at single gang faceplate
6 TV	one broadband at single gang faceplate
7 TV/Satellite	two broadband at single gang faceplate
8	one data and one broadband at single gang faceplate
9 Standard	two data, two and one broadband voice at double gang faceplate
10 Wall Phone	one voice at wall phone station
11 Elevator Phone	one voice at terminal block for elevator
12 Exterior Phone	one voice coiled in box for exterior phone
13 Empty Box for Future	Empty telecom box with blank cover plate

Table 17.4 Types of Outlets in Typical Rooms

- ELFEXT
- PS-ELFEXT
- Return Loss

For fiber optic cables, perform attenuation testing for all strands in cables under 200 feet in length using a power meter. In cables over 200-feet, perform optical time domain relfectometer (OTDR) testing for each finer optic cable tested. Provide a written test result for each strand in each cable placed.

17.4 AUDIOVISUAL DESIGN

Audiovisual systems are required and shall be provided throughout each courthouse. Audiovisual (AV) systems require appropriate spaces, pathways, cabling, and grounding to support audiovisual equipment throughout the courthouse. Telecommunications and audiovisual system designs shall be coordinated to avoid duplications and conflicts. Courtroom technology provides a means for improving the efficiency and quality of judicial proceedings. Training, education, news and information for judicial branch staff are enhanced by the use of audiovisual systems.

17.5 AUDIOVISUAL DESIGN OBJECTIVES

To inform design professionals of the required building infrastructure to support the installation of a structured, standards-based audiovisual infrastructure, including spaces, pathways, work areas, cabling, grounding and bonding, administration, and verification of performance. To meet this objective, design professionals must be familiar with the standards cited in Chapter 20 Appendix, and follow those standards, except as modified by this section. Best practices for the design and construction of court technology infrastructure in a new courthouse will be identified.

17.6 AUDIOVISUAL DESIGN CRITERIA

The following are criteria and best practices to be followed by design professionals:

- Verify installed equipment is adequately ventilated. Coordinate equipment heat loads with mechanical engineer.
- Coordinate with electrical engineer that conduit and power requirements for courtroom technology are provided.
- Do not specify equipment to be under counters. Use ventilated equipment rooms instead.
- Specify critical replacement parts, such as projector bulbs.
- Provide dedicated circuits for AV Equipment. Tie the AV system ground to the telecommunications ground where practical.

17.7 DESCRIPTION OF COURT TECHNOLOGIES

The following lists the technology needs of each courtroom station and ancillary spaces in the courthouse. These describe active electronic systems in a fully equipped courtroom. Provide infrastructure for all systems; the inclusion of certain elements marked optional shall be determined by the design professionals during the architectural programming phase.

Courtroom

Provide a courtroom audio system with speech reinforcement for each courtroom. The courtroom audio system shall include the following features and sub-systems:

- Voice reinforcement
- Audio playback
- Audio teleconferencing
- Sound masking over jury box for bench conferences, or white noise
- Holding cell audio feed (optional)
- Assisted listening system, or infrared wireless with belt packs. A two-channel system shall be specified, as the second channel can be used for call-in to language interpretation services
- Six-inch LCD touch control panel: to enable operation of the audio system, including volume levels, microphone override and mute capability, conference calling, and activation of sound masking system. The control system will also enable a straightforward upgrade path for adding evidence presentation systems.
- Four-channel audio feeds with headphone jack at reporter's station receptacle plate to allow con-

nection to recording device (optional)

Other Court Systems

For systems in the courtroom and other courthouse spaces refer to Table 17.5 Court Systems AV Requirements.

Baseband Audio-Video Distribution

Provide space for a single equipment rack in the Equipment Room for facility-wide and point-to-point distribution of baseband audio-video signals. This signal connectivity would occur via Category 6 cabling. The connectivity would occur from all AV enabled rooms, including: courtrooms, conference rooms, training rooms, media rooms, and jury assembly. Signal from these rooms would be distributed initially through a floor serving telecommunications room. The baseband AV equipment rack could also house CATV distribution, allowing baseband AV signals from anywhere in the building to be modulated and distributed facility-wide on the broadband cable system.

MATV, CATV, and Broadband Uplink

Provide space and structural accommodation on the roof for satellite dish antennas with southern exposure. Provide infrastructure for two 18-inch to 24-inch wide dishes for each court building. Signals from these antennas shall be routed to receiving equipment in the Equipment Room baseband and broadband distribution rack. The rack would include channel strippers and modulators to allow court created programming to be viewed on the CATV system. If the trial court and related justice agencies share occupancy of the court building, the CATV system described here shall be dedicated to use be by trial court only

Media and Press Area

Larger court facilities require an exterior location for satellite uplink trucks. The courthouse baseband audio-video signal distribution system shall route to a connection monument in the parking lot, so press electronic news gathering (ENG) vehicles can receive signals generated by the courtroom audiovisual systems. In urban areas where an exterior location is not feasible, or in smaller courthouses, an interior location, not necessarily near courtrooms, shall be designated for a media and press area.

Media and press area requirements include:

- Media feed from Equipment Room to the media and press area. This may have only infrastructure

COURT AREAS

	Analog Phone Line	Audio Recording	Audio Reinforcement	CATV	Equipment Rack	Language Interpretation	Microphone	Projection Screen	Real Time Transcription	Touch Panels	Video Conferencing	Video Feeds	Video Projector	Video Recording
Courtroom	•	•	•		•	•	•	•	•	•	•	•	•	•
Jury Deliberation Room														
Executive Conference Room	•			•	•			•			•		•	
Chambers Suite	•			•								•		
Family Courts / Mediation		•									•	•		•
Training Room	•		•	•	•			•		•	•		•	
Jury Assembly			•	•	•	•	•							
Holding Cell												•		

Table 17.5 Court Systems AV Requirements

to a designated or multipurpose room.

- View to southern horizon from exterior satellite uplink trucks
- Stainless steel 18-inch by 18-inch weather and vandal resistant media pedestal cabinet in parking lot or location at the exterior face of the building.

Courtroom Videoconferencing Systems

Videoconferencing systems provide live two-way audio and video transmission of speech and images between a courtroom and a remote site, such as a prison or location of an expert witness. Cameras shall be placed so that they provide a clear view of the judge, the litigants and their attorneys, but not the jury. A videoconferencing codec, or an encoder and decoder, can be mounted with the other courtroom technology equipment or in a central location where it can be shared between courts. Videoconferencing can also be provided with a mobile cart in conference rooms, training rooms, and courtrooms. AC power and data connection shall be provided at the cart position.. Video conferencing systems must be coordinated with the courtroom sound reinforcement system

17.8 COURTROOM SIGNAL INFRASTRUCTURE

Signal pathways, conduit and junction box locations, and other building infrastructure are required to accommodate current and emerging courtroom technology systems. Signals sources, such as microphones or audiovisual devices generated at each courtroom station, shall have a pathway to an equipment room. The following describes the infrastructure requirements of the equipment room and each station.

Courtroom Audiovisual Equipment Rooms

See Telecommunications Equipment Room description. Audiovisual rooms can be combined with telecom rooms if the room is segregated. Electronics for courtroom audiovisual systems shall be rack-mounted in equipment rooms near the courtrooms. Minimize the length of audiovisual cable runs.

To access the front and back of audiovisual equipment racks, which are 30-inches on each side, provide spaces per the standards cited in the telecommunications section. Smaller rooms or closets would require equipment racks on slide-out rail systems for servicing. These rooms will not be occupied but can be combined telecommunications and Audiovisual needs if space needs are met.

Provide two 20-amp isolated ground circuits via AC quad-plex and four RJ 45 data outlets to the equipment rack location. Equipment shall not be stored under a counter within the courtroom.

If Audiovisual and telecom equipment rooms are separate, provide a signal pathway equivalent to a 1-1/4-inch conduit between each AV closet and the floor serving telecommunications room. This is to allow baseband audiovisual signal to be routed to head end audiovisual racks in the Equipment Room.

Baseband and Broadband in Equipment Room

Adequate signal pathways from local serving telecommunications rooms to the Equipment Room shall be provided for baseband and broadband signaling. Each AV enabled room in the building shall have capacity equivalent to 1-1/4-inch conduit from the equipment rack location to the local serving telecommunications room for baseband and broadband signal routing.

Courtroom Locations

The following is a description of the standard outlet box sizes and pathways at each outlet courtroom station.

Junction boxes are oversized to accommodate flexibility and future growth. Conduit shall route from each junction box to the equipment rack. Conduit count indicates necessary wire capacity and signal separation. Equivalent capacity and separation can be provided in raceways or other signal pathways in millwork. Intermediary conduit collection boxes above ceilings shall be used to reduce conduit runs to the equipment rack.

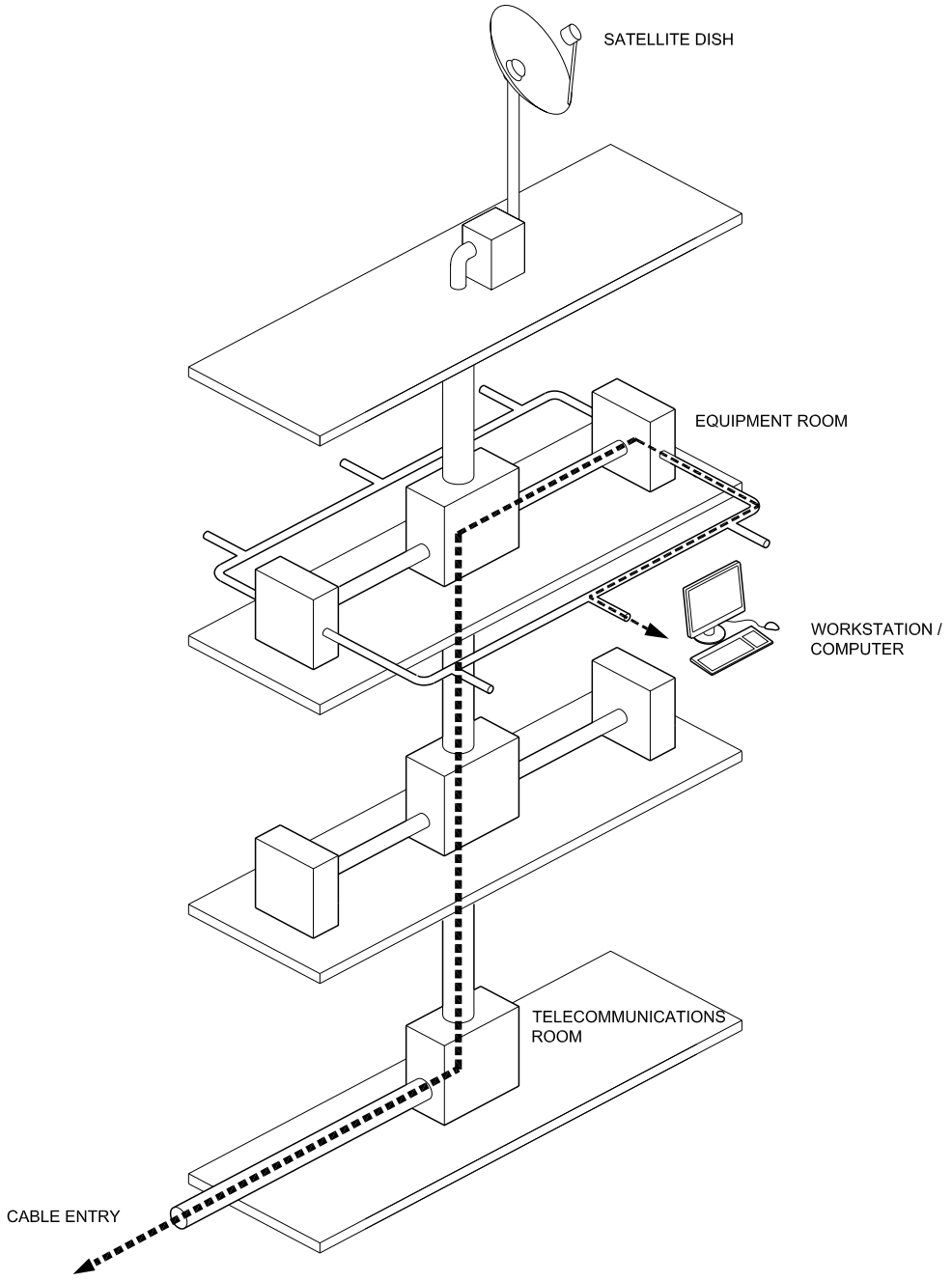

Figure 17.1 Building Cabling Diagram

OUTLET SPECIFICATIONS
Judge 5-gang boxes in the millwork knee space Three one-inch conduits back to equipment rack location Horizontal low voltage wire management in knee space Horizontally-mounted power receptacles on plug-strip
Clerk 5-gang boxes in the millwork knee space Split loom, ENT, or two one-inch and one 1-1/4-inch conduits back to equipment rack location Horizontal low voltage wire management in knee space Horizontally-mounted power receptacles on plug-strip 5-gang boxes in the ledge above work surface
Reporter 5-gang boxes in floor box or front of bench Split loom, ENT, or two one-inch and one 1-1/4-inch conduits back to equipment rack location Horizontal low voltage wire management in knee space Horizontally-mounted power receptacles
Witness 5-gang junction boxes in the millwork knee space Two one-inch and one 1-1/4-inch conduits back to equipment rack location Horizontal low voltage wire management in knee space Horizontally-mounted power receptacles on plug-strip
Public Seating Floorbox or wall-box (locations to be determined) Two one-inch conduit to equipment rack location 3/4-inch conduit to equipment rack location
Jury Conduit for LCD displays (verify with local court) 2-gang box at each end of railing for microphone input Two one-inch conduit to equipment rack location
Camera wall plates (verify locations) One 1-1/4-inch conduit to equipment rack location One three-gang junction box to accommodate 1-1/4-inch conduit
Ceiling Projector (verify projector location with local court) One 1-1/4-inch and one 1-inch conduit to ceiling location Electrical power outlet at projector location with 10 amp capacity Three-gang junction box to accommodate 1-1/4” conduit Provide power and controls for projection screen
Jury Assembly Provide equipment rack location Provide AC power and one-inch signal conduits for distribution to ceiling mount video monitors Provide four (RJ45) data network services to equipment rack Provide twenty-amp circuit at equipment rack
Training Room Provide equipment rack location Provide AC power and conduits for projector and projection screen Provide AC power and conduits to floorbox at conference table Coordinate lighting requirements for video conferencing Provide four (RJ45) data network services to equipment rack
Provide 20-amp circuit at equipment rack

Table 17.6 Room Outlet Specification Table

COURTROOM STATION REQUIREMENTS
Judge
Microphones on movable base with integral mute switch
Under-counter receptacle plate
Witness
Millwork mounted microphone with shock mount
Microphone input to translation system
Under-counter receptacle plate
Connection for powered loudspeaker
Clerk
Microphones on movable base with integral mute switch
Remote control touch panel to control AV system (by decision of local court)
Under-counter receptacle plate audio for multi-channel recording system
Connection for powered loudspeaker (by decision of local court)
Court Reporter (AOC to verify)
Under-counter receptacle plate audio feeds for court recorder
Headphone input with volume control
Counsel Tables
Two microphones on movable base with integral mute switch per table
Microphone input to translation system
Floorbox signal receptacles under table
Jury
Microphone input
Sound masking
Courtroom Lectern
Floorbox with signal receptacles
Integral microphone
LCD panel for evidence display touch annotation (Infrastructure Only)
VCR

Table 17.7 Courtroom Station Requirements

- Multiple purpsoe courtroom shown, outlet locations are similar in large or arraignment courtrooms.
- Additional outlets maybe provided for specific requirements.

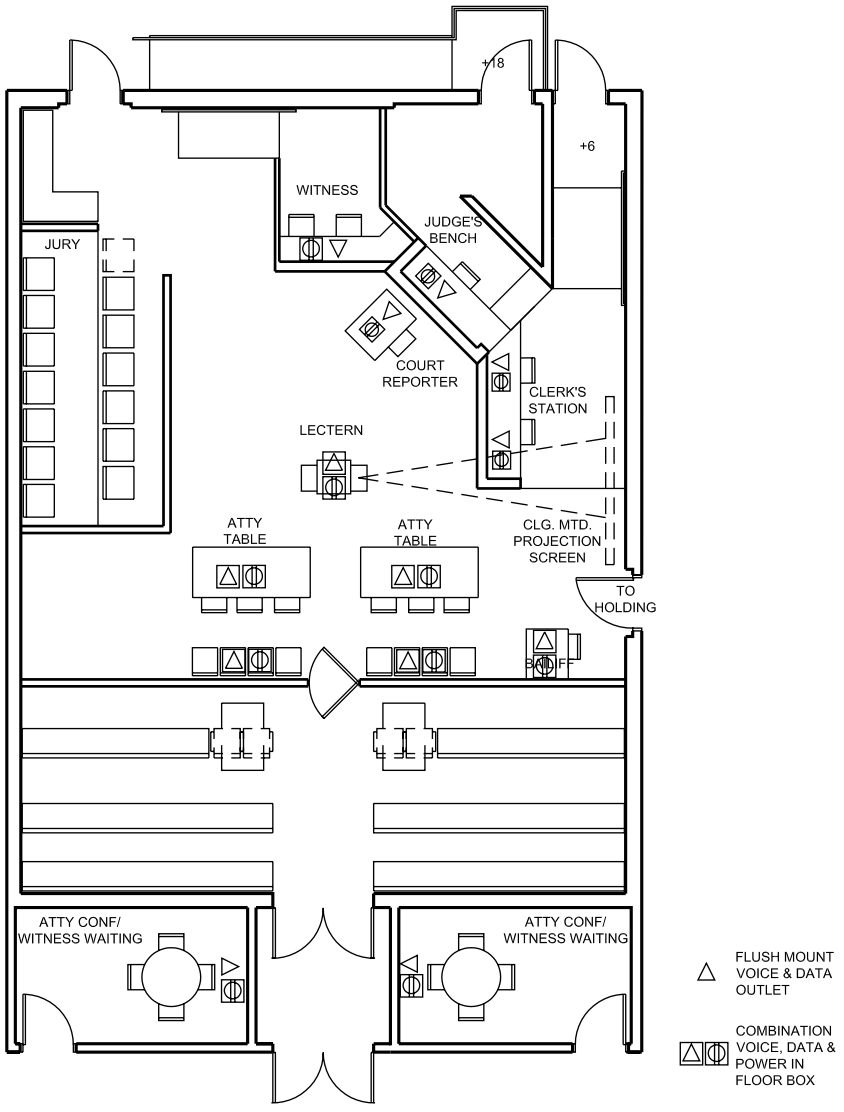

Figure 17.2 Data Outlet Location Diagram

- Multiple purpsoe courtroom shown, outlet locations are similar in large or arraignment courtrooms.
- Additional outlets maybe provided for specific requirements.

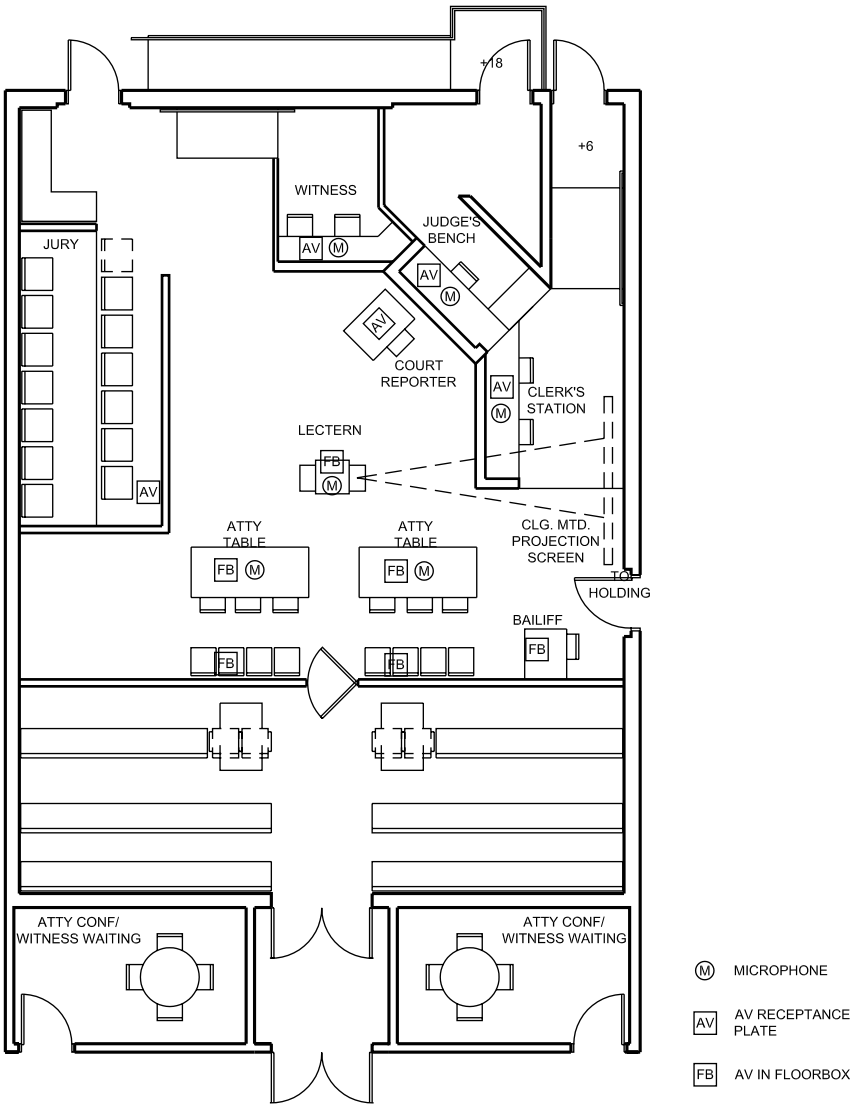

Figure 17.3 A/V Device Location Diagram

- Multiple purpsoe courtroom shown, outlet locations are similar in large or arraignment courtrooms.
- Additional outlets maybe provided for specific requirements.

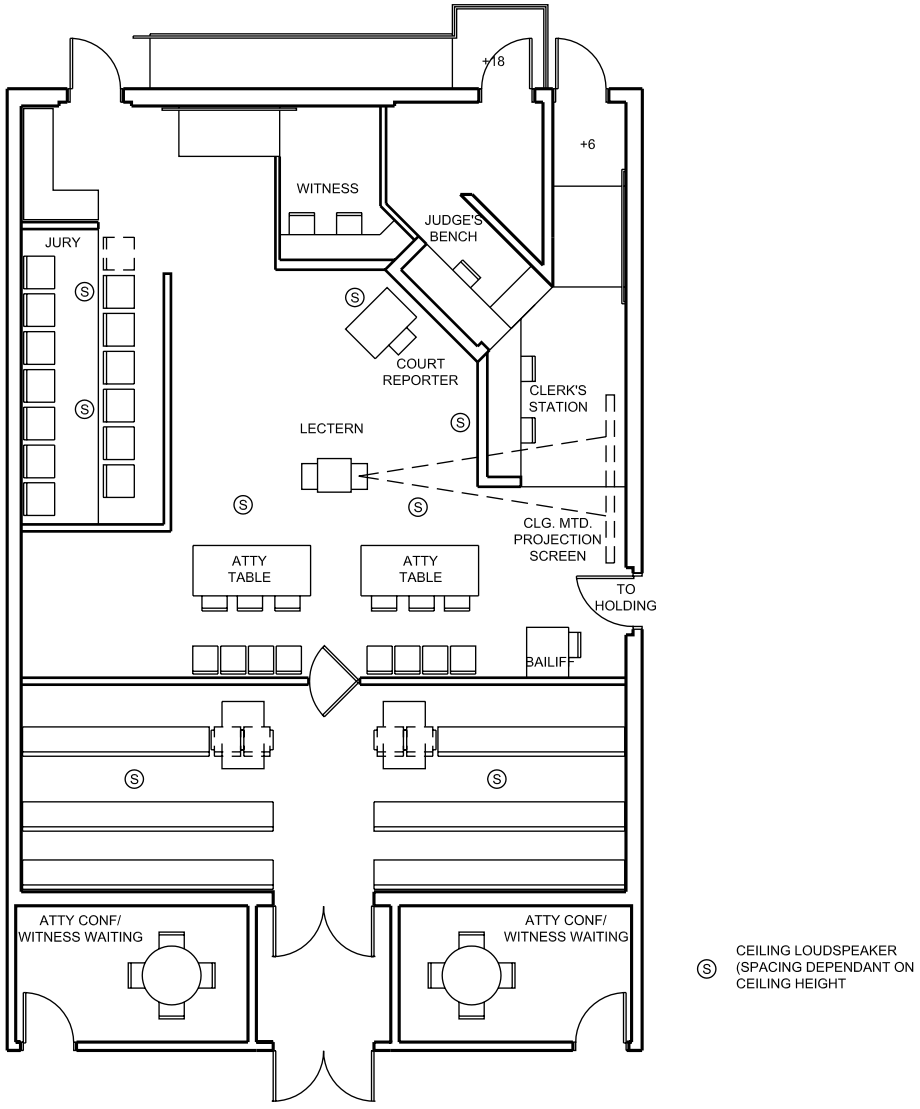

Figure 17.4 A/V Ceiling Speaker Location Diagram

18

ACOUSTICAL DESIGN CRITERIA

Conference Room

Unknown
??, CA
HOK Architects

18. ACOUSTICAL DESIGN

This chapter provides acoustical design criteria for acoustical and mechanical vibration reduction in new court facilities.

18.1 OBJECTIVES

The goal of this chapter is to address best acoustical best practices for courtroom reverberation, echo control, environmental noise reduction, sound isolation, speech privacy, and noise reduction of mechanical and electrical equipment. Each courtroom, except for very large courtrooms, shall be designed for effective spoken communication with a minimum of sound reinforcement. In the standard size trial courtroom all participants shall be able to hear and be understood at normal speech volumes.

18.2 ACOUSTICAL DESIGN CRITERIA

Acoustical criteria are described by numbers defining performance standards.

Considerations

Factors to be considered during acoustic design include background noise levels, sound insulation, and room finishes. Acoustical conditions in courtrooms shall function without a speech amplification system if required. Courtrooms shall be quiet, free of detectable echoes, and shall naturally reinforce voice levels with strategic placement of sound reflecting surfaces.

Background Noise Levels

Vibrations and equipment noise shall not disrupt judicial proceedings.

The background noise level of an enclosed space is quantified by Noise Criterion (NC) curves, published in American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) Handbook of Fundamentals.

Refer to Table 18.1 (Background Noise Criteria) for the recommended HVAC noise criteria (NC) for courthouse spaces.

Room Acoustics

Room acoustics, including reverberation and echo control, are created by the presence of sound reflections in an enclosed space that result in reverberation, echoes and early reflections. The amount of reverberation directly relates to room size and surface treatments. Hard surfaces, such as untreated gypsum board and wood paneling, will cause greater sound reflections and reverberation in a space. Soft surface materials, such as acoustical tile and fabric wrapped fiberglass panels, will result in fewer echoes and less reverberation. However, a room with too much sound absorption on its wall surfaces can be perceived as acoustically "dead." To achieve the proper balance of balance of sound reflecting versus absorbing surfaces,

Noise Criteria[1]	Space Type - Room(s)
NC 30	Courtrooms Conference Rooms Meeting Rooms Training Spaces
NC 35	Judicial Chambers Enclosed Offices Jury Deliberation Clerks Office
NC 40	Reception Lobbies Workroom Open Office Corridors
NC 50	Warehouses Parking Garages Fire stairs

Table 18.1 Background Noise Criteria

1) **Noise Criteria** *(NC) Single-number rating based on a set of spectral curves used to describe the "noisiness" of environments for a variety of uses. NC is typical used to rate the relative loudness of ventilation systems.*

alternating "hard and "soft" surfaces can be installed on the sidewalls in four-foot wide segments. The panels shall be arranged such that a hard surfaced panel directly faces a soft panel on the opposing wall. A hard-surfaced wall shall be located behind the judge, witness and the clerk to provide good projection of voice to the jury.

Reverberation is the effect of sound scattering and steadily decaying in a room. Conversely, echoes are distinct, late arriving reflections from a single wall surface. In excess, reverberation can adversely affect speech intelligibility.

Echoes in a courtroom shall be avoided. Sound from the judge's bench reflecting off the back wall at the other end of the courtroom can be source of echoes. The courtroom back wall shall be treated with acoustically absorbing material. Conversely, walls behind the judge's bench shall be of acoustically reflective materials so that sound generated from the judicial area is reflected to the rear of the courtroom. This reflected sound is defined as an early reflection, and will not be heard as a distinct echo. A hard surface ceiling slightly tilted outward six degrees or more will have the effect of projecting voice into the room, without creating a flutter echo with the hard surfaced bench counter.

Refer to Table 18.2 (Room Acoustic Requirements) for room acoustic requirements for courthouse spaces.

Sound Insulation

Sound insulation is the capacity of a structure to prevent sound from being transmitted from one space to another. In courthouses, greater sound insulation enhances speech privacy. Higher levels of sound insulation are required when acoustically sensitive spaces are located near sound generating equipment.

Partitions with greater mass or larger insulated airspaces allow higher sound insulation values, and will perform better than construction with high air infiltrations. Flanking paths, such as above-ceiling ducts or window mullions at partitions, degrade sound insulation performance.

Sound insulation is quantified by two numerical ratings, Noise Isolation Class (NIC) and Sound Transmission Class (STC). NIC is a field-measured noise reduction from a building design element. STC is a sound insulation performance, as measured in a controlled laboratory.

Refer to Table 18.4 (Sound Isolation Requirements) for sound isolating performance requirements for courthouse spaces.

Speech privacy within a space depends on the sound insulation performance of its partitions and doors, and the background noise levels in adjoining spaces. Confidential speech privacy is defined as when speech, while detectable, no individual words can be discerned; Sound Insulation of construction and

Space Type	Room Acoustic Considerations
Courtrooms	Reverberation time (RT_{60})[2] criteria 0.6 to 1.0 seconds. Treat ceiling and wall surface with sound absorbing materials to meet reverberation time criteria. Wall behind Judge's Bench can be hard surfaced and sound reflecting
Enclosed Offices Judicial Chambers Conference Rooms Training Spaces Jury Deliberation Clerks Office	Acoustical ceilings should have a minimum NRC of 0.65
Open Office	Acoustical ceilings should have a minimum NRC of 0.65
Lobbies	Reverberation time less than 1.5 seconds. Sound absorbing ceiling should be considered if not carpeted.

Table 18.2 Room Acoustic Requirements

2) **Reverberation Time (RT_{60})** *The time (in seconds) required for the sound pressure level to decrease 60 (decibels) in a room after the noise source is abruptly stopped. Reverberation time relates to a room's volume and sound absorption.*

Noise Criteria for adjoining space is greater than 80. For example, if the space adjoining the space under consideration has a background noise level of NC 30, the intervening partition must have an STC rating of 50 to achieve confidential speech. Unless a reliable source of background noise such as sound masking is provided in the adjoining space, an STC 50 construction assembly is generally required to achieve confidential speech privacy. To achieve a "normal" speech privacy level, the sum of both numbers shall equal 70 or more.

A partition allowing confidential speech privacy shall be full-height, use light gauge studs (25-gauge) with

Space Type	STC Door
Courtroom to Courtroom Courtroom to Jury Deliberation	Doors not recommended, use vestibule if possible. If not possible use only a Laboratory Rated STC 53 (or two gasketed doors in tandem)
Jury Deliberation (sound masking in corridor recommended) Judge's Chambers Judicial Conference Attorney Conference (to public vestibule)	Laboratory Rated 43 (Sound masking in corridor recommended)
Courtroom Public Vestibule (both door sets) Court Reporter Conference Room Electric Mediation Investigators Office Courtroom to Secure Vestibule/ Hallway	Acoustically Gasketed Non-Rated

Table 18.3 Door Requirements

Space Type & Adjacency	STC of Partition*
Courtroom to Holding Cell Electrical Transformer to NC 30 Space or less Elevator Shaft to NC 30 space or less Hydraulic Elevator Equip to NC 30 space or less	65
Courtroom to Courtroom Judicial Chambers to adjoining areas Judicial Conf. Rms. to adjoining areas Jury Deliberation to adjoining areas Family Law mediator to adjoining areas Toilet room to adjoining spaces	50-55
General Office Space to General Office Space Orientation to adjoining areas Telecom AV rooms to adjoining areas	40
Office Equipment to adjoining areas Workroom to adjoining areas Children's waiting room to adjoining areas Computer Room Spaces to adjoining areas Conference, Meeting and Training Spaces to adjoining spaces	45

**Partitions with doors need only be 10 points greater than STC of door*

Table 18.4 Sound Isolation Requirements

two layers of gypsum board on one side, a single layer on the other, with batt insulation in the stud cavity. If heavier gauge studs must be used, additional layers gypsum board double, or staggered studs are an option. Sound-rated partitions shall be acoustical sealed around the entire perimeter. Refer to the "Catalog of STC and IIC Ratings for Wall and Floor/Ceiling Assemblies" by the Office of Noise Control, California Department of Health Services.

The following are recommended doors for various courthouse spaces:

Environmental Criteria

- To identify noise levels in decibels (dB, or dBA) at a potential site under consideration, conduct a 96-hour environmental noise study that tests for average and single event noise. Perform this study for all potential courtroom sites near roadways, highways, trains, busy urban areas, and flight paths. The average sound level over a 24-hour period is known as the Day-Night Average Level (DNL).
- Based on results of the environmental noise study, calculate exterior facade STC to achieve an interior DNL of 40 and maximum single event of 50 dBA.

18.3 BEST PRACTICES

The following recommendations address: noise reduction from mechanical and electrical equipment, sound insulation, speech privacy, and room acoustics.

Mechanical and Electrical Equipment Noise Reduction

- Do not locate variable air valve (VAV) units above courtrooms chambers, or conference and other rooms with noise criteria of NC 35 or less. Instead, locate VAV units in corridors. If this is not possible, a gypsum board ceiling or enclosure around box may be required.
- Select air diffusers five points below the NC rating of the room they serve.
- Locating air-handling units (AHUs) and other noisy equipment above courtrooms or other noise-sensitive spaces may require expensive and complicated sound attenuating ceilings.
- Locating fan-powered VAV boxes above spaces with noise criteria of NC 45 or less may require expensive and complicated sound attenuating ceilings
- Do not exceed 1.25-inches of static pressure at VAV box inlets.
- Do not use rooftop "down discharge" air-handling units if possible. Instead, use side-discharge units. Noise mitigation of down discharge may be prohibitively complicated and expensive.
- Locate volume dampers at least 10 feet upstream from air diffusers in rooms with an NC criterion of NC 35 or less. Do not use face dampers.
- Vibration: isolate all mechanical equipment per ASHRAE guidelines.
- Do not use seismic restraints that are integral to vibration isolators. Instead, use independent seismic restraints.
- Supply air ductwork: Ductwork attached to the fan discharge is to be connected with a flexible connection. Allow room for a five-foot silencer near the fan.
- Make provision for a five-foot silencer at the supply-air side of air-handling units
- Ducts penetrating sound-rated wall, floor, and ceiling assemblies shall be in an insulated sleeve between independent construction elements. Ducts penetrating the building structure shall have a clear distance of 1.25-inch around the perimeter. This perimeter void must be packed with glass-fiber batts at both ends, and caulked airtight with a non-shrinking, non-hardening flexible acoustical sealant with a backer rod.
- To vibration-isolate transformers, inverters, rectifiers, and UPS, use flexible conduit and resilient mounts with a minimum static deflection of 0.25-inches.
- Avoid locating transformer rooms near sensitive locations. If not possible, consider double stud construction. Vibration isolate units.
- Provide transformers with sound levels that do not exceed the following maximums in accordance with NEMA and ANSI standards. The manufacturer is to verify that the actual sound

levels comply by conducting sound tests, prior to shipping to the project site.

25 - 50 KVA, 45 dB
51 - 150 KVA, 50 dB
151 - 300 KVA, 55 dB
301 - 500 KVA, 60 dB

Sound Insulation and Speech Privacy

- Return-air path for rooms requiring confidentially speech privacy: install three-foot long acoustically lined sound-boots with at least one turn. Aim air opening away from corridor.
- Full-height partitions shall be required between adjacent rooms where confidential speech privacy is required.
- Use light-gauge studs (25-gauge) and batt insulation at sound-isolating construction. If light-gauge studs are not possible, use resilient channels instead.
- Use non-hardening acoustical sealant at partition intersections.
- Do not locate electrical and low-voltage junction boxes back-to back, instead locate in separate stud cavities. Seal the back of electrical boxes with an approved sheet caulking.
- Where full-height partitions are not possible and confidential speech privacy is required, provide sound masking in a space where listening should not occur.
- Avoid duct paths that will create "crosstalk" between spaces. Instead, provide minimum ten feet long acoustically lined ducts with two turns between acoustically sensitive spaces.
- For partitions requiring normal speech privacy, use a foam seal tape between top of partition and the lay-in ceiling or extend partition six inches above ceiling.
- Provide sound-lock vestibule at courtroom entry from public corridor. Provide two sets of solid-core, acoustically gasketed doors.
- Provide sound masking where construction does not allow adequate speech privacy.
- Sound isolating doors: doors with cam-lift hinges and thresholds work best. For standard hinges, use threshold with integral gasketing. Doors with drop-bottom gasketing will require periodic maintenance to align seals. Do not use noisy panic hardware.
- Sound isolating doors: Use dual gaskets, such as compression sound gaskets and smoke gaskets, in tandem.
- Recessed junction boxes must be offset at least 16 inches on opposing sides of sound-rated construction.
- Recessed junction boxes four-gang and smaller are to have the back and sides sealed airtight using sheet caulking. Junction boxes larger than four-gang require gypsum board backing.
- Conduit must not bridge independently framed sound-rated partitions or resilient ceilings by rigidly connecting to the framing. Flexible conduit connections are required.
- Where equipment noise and vibration do not meet these standards, sound isolating, or floating floors, may be required for mechanical rooms where space below is occupied.
- For adjacent spaces along exterior window façade where speech privacy is required, treat window mullion with a layer of wood or gypsum board on each side of partition where the partition intersects at the exterior window

Room Acoustics

- Fabric-wrapped sound absorbing panels shall be a minimum of one-inch-thick and minimum NRC of 0.85.
- Fabric for acoustical panels must be porous and allow air to pass. Do not use fabric with acrylic or other backings.
- Avoid concave or domed surfaces. If these surfaces cannot be avoided, they must be acoustically treated. Convex surfaces are better.
- Avoid parallel hard surfaces. Gypsum board and other hard surfaced ceilings over tables and counters with microphones shall be avoided
- Ornate, irregular or convex surfaces will minimize

echoes.

- Carpet alone does not provide good room acoustics.

19

FIRE PROTECTION

courtroom

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unknown

19. FIRE PROTECTION SYSTEMS

This chapter defines the general and technical criteria for fire protection systems, including recommendations and minimum acceptable performance criteria.

19.1 FIRE PROTECTION OBJECTIVES

Fire protection systems protect life and property from fire through standardization of design, installation, and testing requirements for sprinkler systems, based upon sound engineering principles, applicable state fire code, and field experience. The following design criteria set minimum acceptable standards for design and installation of automatic fire sprinkler systems. New technology and alternate arrangements may be applied, but they shall not reduce safety levels prescribed by these criteria, or by state fire code.

Designers shall use the criteria to develop fire protection systems for new buildings, retrofit of existing unsprinklered buildings, or interior renovation of existing buildings. When the criteria are applied to interior renovations of existing structures, designers shall provide systems that meet design parameters of the existing fire protection system and these criteria, whichever result in a better system that satisfies applicable codes.

19.2 FIRE PROTECTION DESIGN CRITERIA

- All mechanical spaces shall be designed for ordinary hazard, with a density of 0.15 gallons per minute/ square foot (gpm/sf) over 2,500 sq. ft. maximum.
- All other spaces in the building shall be designed for light hazard criteria, with 0.10 gpm/sq. ft. over the most remote 1,500 sq. ft. The sprinkler heads in exposure zones shall be included in most remote area calculations for adjacent ceiling areas.
- The maximum head spacing shall be limited to 200 sq. ft. per head for light hazard, and 130 sq. ft. per head for ordinary hazard areas.
- The hydraulic calculations shall be based upon pressure available at point-of-connection to on-site water supply.
- For fire sprinkler systems in mechanical rooms, provide sprinkler system per NFPA requirements using corrosion resistance, standard response and wax coated brass heads rated for 200 degrees Fahrenheit.
- In high-content-value areas, or where water damage must be minimized, use of a dry system with early alarm and pre-activated system charging control, on-off cycling heads or on-off cycling system.
- Coordinate location of each sprinkler head with reflected ceiling plan, including lighting, diffuser, and grille layout.
- Coordinate the location, signage, keying, and access of fire sprinkler shutoff and zone valves with the local fire authorities. Access and signage shall be obvious. Visibility shall not be blocked by equipment.
- Show a water flow switch for each floor or sprinkler zone where a shunt box is used. Switch shall have one normally open and one normally closed contact. Specify alarm wiring in Division 16 work.
- Show a test valve and drain piping for each flow switch. If required by the local fire authorities specify provision for draining the water for full flow tests to outside into the nearby storm drain manhole. If approved by the local fire authori-

ties, specify drainpipe for controlled flow testing to terminate to an approved receptor within the building. Show the exterior test drain provisions for full flow test and drain receptor for controlled flow tests on the plumbing and sprinkler plans.

- Coordinate sprinkler drain locations with plumbing drawings, and show the drain locations on fire sprinkler drawings.
- Specify sprinkler head guards to be installed on any heads subject to possible damage.

Fire Pump Requirements

Evaluate fire pump requirements based on building size, number of floors, occupancy, and available city water pressure. Specify fire pump, jockey pump, and associated control system in accordance with NFPA requirements.

- Specify that a single manufacturer furnish pumps, motors, transfer switches, all controls, and be U.L. listed.
- Require the pump manufacturer to provide the services of a qualified engineer for start-up and acceptance test, in the presence of local fire and underwriting authorities.

Fire Hose Racks and Cabinets

When required by local fire authorities, specify the fire hose cabinets to be listed for the application, and made by a recognized industry manufacturer. Locate the fire hose racks and cabinets at intervals so that all building areas may be reached with 75 feet maximum hose length.

- Specify flush mounting cabinets for fire hose racks, with wire plate glass doors and space for a 2.5-gallon fire extinguisher. Door shall have chrome-plated piano hinges and chrome plated, unpainted handle.
- Specify racks complete with wall flange, hose, fog nozzle, hose coupling, 1.5-inch valve, and spanner, with chrome plated finishes. Both ends of racks shall lie in the same horizontal plane with a maximum tolerance of +/- 1/8-inch.
- Specify 1.5-inch, Underwriters yellow label, unlined linen hoses, 75 feet long, fitted with fog nozzle.
- Specify National Standard hose thread, for valve and hose, as adopted by the NFPA.

Standpipes

Where code-required, provide wet and dry standpipes in all buildings. Install dry standpipe and fire sprinkler pumper connections together at locations approved by local fire authorities. Specify National Standard hose threads, as adopted by NFPA, for all hose valves.

- Specify that all wet and dry standpipes shall be hydrostatically tested and proved tight under 200 psi of water or to actual pressure if higher than 200 psi. The test must be maintained a minimum of two hours and shall be witnessed by local fire authorities. Where any pipe connections are concealed, the tests shall be conducted before covering.
- Specify that prior to testing, all systems shall be thoroughly flushed of foreign material. The flushing of the system should be started at the highest point in the system to lowest drain point. All portions of the system shall be back flushed.
- Provide piping and valving as necessary to facilitate full flow testing. Test discharge water shall be directed to prevent water damage.

Piping Requirements

- Specify all above ground sprinkler piping to be Schedule 40, black steel, ASTM A-135 and all underground sprinkler piping to be ductile iron, class 50, AWWA C151with cement mortar lining conforming to AWWA C104, with 1-mil thick exterior petroleum asphalt coating. For corrosive soil areas, the underground piping shall be encased in polyethylene encasement in accordance with AWWA C105.
- For aboveground pipe system with system pressure 175 psig and below, specify threaded cast iron fittings for sizes two-inch and smaller. For 2.5-inch and larger size, specify mechanical joints with cut grooved end.
- The sprinkler system drainage piping shall be specified as galvanized steel pipe with galvanized threaded malleable iron fittings.
- Specify corrosion protection for buried ductile iron

pressure piping and supports. All wrapping shall be site installed. Specify cathodic protection as necessary for local conditions.

- Underground piping shall be provided, cleaned and tested per NFPA 24. Terminate underground service where indicated on contract documents.
- Installation: Install above ground pipe, fittings and hangers in accordance with NFPA Pamphlet #13, and local code requirements, including seismic sway and uplift bracing. Additional requirements per earthquake bracing shall be in accordance with NFPA 13 or a structural engineer shall sign the sway bracing details.
- Reducers: Make reductions in pipe sizes with one piece reducing fitting. Bushings will not be acceptable, except when standard fittings of proper size are not manufactured.
- Provide next to sprinkler main risers a framed, printed sheet protected by transparent plastic, safety glass, or Plexiglas cover with brief instructions regarding all necessary aspects of sprinkler controls, and emergency procedure.
- Drains: Install main drain at riser and auxiliary drains at all low points in the system on each floor. Install inspector's test drains on sprinkler system at main riser assembly. Five or fewer trapped heads may be drained through a plugged fitting.
- Sprinkler head clearance between deflectors and walls or ceilings, roof decking or roof joists shall be in accordance with the requirements of the latest edition of NFPA Pamphlet No. 13.
- Exposed piping supplying chrome plated hose valves or fire department connections shall be chrome plated. Chrome plated wall or floor escutcheons shall be provided at point of concealment.
- Install a hinged chrome plated escutcheon at all visible wall, floor and ceiling pipe penetrations.
- Do not run piping through elevator hoistways, machine rooms, machinery spaces and enclosures unless piping is serving these spaces. Branch sprinkler piping serving those spaces shall be provided with a supervised branch shut-off valve located at an accessible location outside these spaces. Furnish tamper switch at these valves.

Valve requirements

Specify valves that are UL listed for the application, pressure classification and manufactured by companies with a full line fire protection system components. Acceptable manufacturers shall be Crane, Jenkins, Stockham, Nibco-Scott, Milwaukee, or approved equal. Model numbers given are for Stockham, unless noted otherwise.

Piping Specialties

- Specify piping specialties that are UL listed and made by a single manufacturer.
- Specify pressure gauges to be 3.5-inch dial with dial range twice the system working pressure, 1/4-inch bottom connection and shut off valve.
- Specify vane flow switches with adjustable time delays, UL listed. Each with two contacts for local and remote alarms, DPDT.
- Specify valve supervisory switches on main and other shutoff valves that can interrupt flow to sprinklers.
- Specify inspectors test valve and drain assembly in accordance with NFPA-13.
- Specify the valve tamper switch to be UL listed, 120 VAC/30 V DC, with DPDT.
- Other specialty items shall be specified as by NFPA 13 or local conditions and codes.

Automatic Sprinkler Head Requirements

Specify the sprinkler heads to be UL listed and FM approved automatic sprinklers in accordance with the following:

- Specify fusible links for 155 degrees to 165 degrees Fahrenheit, except when application requires higher rating.
- Specify 200 degrees Fahrenheit fusible links for sprinkler heads in all switchgear rooms, electrical rooms, elevator machine rooms, mechanical rooms, skylights, and where required by NFPA.
- Specify wax coated sprinkler heads for heads exposed to weather.

- Specify concealed quick response sprinkler heads in courtrooms and public areas, and semi-recessed in offices.
- Specify security detention grade quick-response heads for holding cell areas.
- Specify standard type heads, either upright or pendant, in open ceiling areas and for switchgear rooms, electrical rooms, elevator machine rooms, mechanical rooms and other service areas.

Fire Department Connections

Specify the fire department connections (FDC) to be provided in accordance with NFPA, California Fire Code and local fire department requirements. Threads shall conform to standards of all responding fire departments.

The FDC shall be cast brass or ductile iron body with drop clappers. Chrome plated brass plate with lettering as required by the local fire authorities. Chrome plated brass double female snoots with rigid pin lug hose thread swivels, pin lugs and chains. Hose inlets and threads, National Standard Thread (NST) shall conform to local fire department requirements.

Sprinkler Control Valves

Specify sprinkler control valves to be UL listed, FM approved, all with tamper switches. Specify control valves for 3-inch and smaller to be ductile iron body ball valves. Specify for sizes four-inch and larger control valves to be ductile iron butterfly valves.

Double Check Detector Valve assembly

Specify double check detector valve (DCDV) assembly, consisting of two independently operated spring loaded center guided check valves, and a by-pass assembly. The by-pass shall consist of a 5/8-inch water meter in series with a backflow preventer, both mainline and by-pass assembly supplied with two full port resilient seated shut-off valves for shut-off and four resilient seated ball valve test cocks, cast iron and fusion epoxy coated maincase inside and out with an FDA approved material. Entire unit serviceable in-line. 175 psi rated operating pressure. Assembly shall be UL, FM, ASSE (No. 1048) and USC/FCCC labeled, and be furnished with tamper switches on both mainline shut-off valves.

All double check detector valve assemblies shall comply with local Department of Health requirements.

Post Indicator Valve Assembly

When required by the local authorities, specify UL listed FM approved post indicator valve (PIV) assembly. PIVs shall be monitored by the building fire alarm system.

Water Motor Alarm Requirements

Specify water motor alarm where the local jurisdiction requires them to be provided. The water motor alarm shall be UL, FM, and California State Fire Marshall listed, rated for a working pressure range of seven to 175 psig, Nozzle K-factor of 0.7 gpm/psi.

Data Center, Control Centers and Server Room Protection

For smaller server rooms, telecom rooms less that 200 sq. ft, specify a fire sprinkler system.

For server rooms, telecom rooms in excess of 200 sq. ft. consider either pre-action fire sprinkler system or similar chemical fire suppression systems with standard fire sprinkler system.

FM 200 system shall comply with the most current requirements of ANSI/NFPA-72 Standards, Factory Mutual Guide, and NFPA 2001.

Identification

Specify proper identification and signage be provided at each sprinkler valve with a brass sign indicating what portion of the system the valve controls. Provide signage at each fire department connection, a brass sign indicating what portion of system the connection supplies.

The fire protection risers shall be provided with brass hydraulic data plates permanently attached to the riser, indicating basis of design, water supply and pressure requirements of hydraulically designed systems.

Coordination

Fire protection systems shall be coordinated with other specification sections, such as earthwork, architectural, site utilities, concrete, plumbing, structural, electrical, sheet metal, and mechanical.

All electrical equipment provided under fire protection systems shall be specified with wiring diagrams for interfacing with electrical work.

Coordinate with the building fire alarm system for transmitting all flow and tamper alarms, and integrating with fire alarm and smoke control systems.

Guarantee

Specify that fire protection work shall be free from defects of workmanship and materials for one year after filing notice of completion, and remedy any defects developing during this period, free of charge. Manufacturers whose equipment has a longer guarantee period shall provide a written guarantee.

Flushing, Tests and Adjustments

Specify that after piping installation has been completed, the entire system be flushed to remove foreign substances under pressure as required. Flushing shall continue until water is clear and checked to ensure that debris have not clogged sprinklers.

Specify all testing to be done in the presence of the following personnel: local fire authorities, municipal inspector, Office of the State Fire Marshal, owner's representative.

Test all piping at not less than 200 psig pressure, unless fire authorities require stricter tests. Test duration shall be two hours for piping downstream of the floor control valves provided the test is performed during normal working hours. Flush and test until accepted: all underground piping before connecting above grade piping at riser connection.

Specify to perform operational and alarm tests under simulated or actual service conditions, including one test of complete fire protection system installation with all appliances connected. Should any material or work fail in any of these tests, it shall be immediately removed and replaced by new material, and the portion of the work replaced shall be retested.

Installation Contractor Certification

Specify the fire protection system shall require the installation contractor to submit all certificates in triplicate indicating approval of work, approval or performance of tests, and of final inspection issued by fire marshal before final acceptance of sprinkler system.

Cleaning

Specify that the sprinkler heads placed prior to painting be covered with small paper bags, UL approved, which shall be removed only after painting is completed. After painting is completed, remove bags, clean and polish each head.

19.3 FIRE ALARM SYSTEM CRITERIA

The fire alarm and notification system shall be UL listed, California State Fire Marshal approved and manufactured by firms regularly engaged in manufacturing of fire detection, alarm and communications systems, of types, sizes, and electrical characteristics required, and whose products have been in satisfactory use in similar service for not less than 5 years.

19.4 FIRE ALARM SYSTEM OBJECTIVES

Fire alarm system design shall provide safe installation and operations through standardization, installation, and testing requirements, based upon sound engineering principles, applicable State and local codes, and field experience. The criteria set minimum acceptable requirements for design and installation of the building fire alarm system.

Designers shall use these criteria to develop fire alarm systems for new buildings, retrofit of existing buildings or interior renovation of existing buildings. When the criteria are applied to design of interior renovations of existing structures, the designer shall provide systems that meet the design parameters of the existing building fire alarm system and these criteria, whichever result in a better system that satisfies applicable codes.

19.5 FIRE ALARM SYSTEM DESIGN CRITERIA

The fire alarm and notification system shall be UL listed and made by an approved manufacturer. The fire alarm system shall be fully addressable, Class B wiring throughout, all wire in conduit, minimum .75-inch.

The fire alarm system shall be specified with the following:

- Fire alarm system shall use closed loop initiating device circuits with individual zone supervision, individual indicating appliance circuit supervision, incoming, and standby power supervision.
- Fire Alarm system annunciator panel shall be located in the security control room or fire con-

trol room of the building, indicating in summary form the zone alarmed. The annunciator shall be equipped with: indicating lights for each floor indicating the location of the alarm; lights indicating the source of the alarm, pull station, duct detector, smoke detector, elevator lobby detector, sprinkler flow or tamper switch, or PIV valve; and shall provide a full level of information for fire department personnel arriving at the building.

- Provide individually addressable pull stations at each stairwell at each level and at each exit.
- Provide individually addressable smoke detectors in all elevator lobbies, electrical rooms, telephone rooms, utility rooms, and elevator machine rooms.
- Provide individually addressable duct detectors on all supply fan outputs for fans exceeding 2,000 CFM, and on any associated ducted return fans.
- Provide ADA level horn-strobes at each corridor, elevator lobby, restroom, open office area, and all other locations required by code.
- Any other zoning or features required by the fire department or other code authorities.
- The Fire Alarm system shall be fully addressable type with Class B wiring throughout. All wiring shall be in minimum .75-inch size conduit. The system shall be complete with initiation and annunciating devices including but not limited to the manual pull stations, ceiling and duct mounted product of combustion detectors, alarm speakers, horns, ADA and NFPA 72 compliant strobe lights with 100 Candela output, fire protection water flow detection, valve position indicators, door unlocking, and holding devices.
- The fire control and command panels shall be located adjacent to the fire department emergency response location at the facility exterior. The facility security control and command center shall not be combined with fire control, command panels and center, without AOC approval.
- The fire control and command panels shall be located adjacent to the fire department emergency response location.

Quality Assurance

All materials specified shall be the best available, new, and approved by UL and the California State Fire Marshal.

Specify that all panels and peripheral devices shall be the standard product of a single fire alarm system manufacturer, under the appropriate U.L. category.

- Installer shall be qualified with at least five years of successful installation experience on projects with fire detection, alarm, and communications systems installation work similar to that required for the project.
- Comply with NEC as applicable to construction and installation of fire detection, alarm, and communication system components and accessories.
- The fire detection, alarm, and communication system components and accessories shall be NFPA, FM and ADA compliant.

Identification

Specify the proper identification and signage be provided at each fire alarm panel, conduits, branch circuits, pull boxes, and J-boxes using industry standard materials and methods.

Coordination

The fire alarm system shall be coordinated with other specification sections, such as architectural, site utilities, plumbing, fire sprinkler system, electrical, telephone, data, security, building management system (BMS), and mechanical systems.

Guarantee

Specify that the fire alarm work shall be free from defects of workmanship and materials for one year after filing notice of completion and remedy any defects developing during this period, free of charge. Manufacturers whose equipment has a longer guarantee period shall provide a written guarantee.

Tests and Adjustments

Specify that after installation has been completed, the entire system be tested in accordance with the NFPA-72 by the contractor in the presence of the local fire and building authorities, and the owner's insurance underwriter.

Installation Contractor Certification

Specify the fire alarm system installation contractor shall submit all certificates in triplicate indicating approval of work, approval or performance of tests, and final inspection issued by local authorities.

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APPENDIX

20. Codes and Standards

All new facilities designed and constructed using the Facility Standards shall, to the maximum extent feasible, comply with the following codes and any other applicable nationally recognized codes. Requirements exceeding those expressed in the list below are described in the Facility Standards text.

20.1 BUILDING CODES AND STANDARDS

The following codes and standards shall apply:

- California Building Code (edition in effect as of the commencement of schematic design phase of a particular court project)
- California Government Code
- California Code of Regulations, Title 24
- California Energy Code
- Americans with Disabilities Act (ADA)
- American Disability Act Accessibility Guidelines (ADAAG)
- Universal Design concepts
- Division of the State Architect (DSA) Access Checklist

20.2 MECHANICAL DESIGN CODES AND STANDARDS

Unless specifically directed otherwise by the program document, the following HVACR Codes, Standards and preferred design concepts below shall be used as guidelines for design.

The latest editions of publications and standards listed below are intended as guidelines for design. They are mandatory only where referenced as such in the text of this chapter or in applicable codes. The list is not meant to restrict the use of additional guides or standards. When publications and standards are referenced as mandatory, any recommended practices or features shall be considered 'required'.

Codes

- California Mechanical Code
- California Electrical Code
- California Fire Code
- California Plumbing Code
- California Code of Regulations: Title 8, Industrial Safety Orders

Standards

- ANSI/EIA/CEA -709.1- B-2000 Control Network Protocol Standards
- AMCA: Air Movement and Control Association Inc. Certification Ratings
- American National Standards Association Standards
- American Society of Testing and Materials:
- American Society of Mechanical Engineers: ASME Manuals.
- American Society of Plumbing Engineers: ASPE Data Books
- ARI: Air-Conditioning & Refrigeration Institute Standards
- ASHRAE: Standard 15: Safety Code for Mechanical Refrigeration

- ASHRAE: Standard 52.2: Method of Testing General Ventilation Air Cleaning Devices for Removal Efficiency by Particle Size.
- ASHRAE: Seismic Restraint Manual Guidelines for Mechanical Systems
- ASHRAE: Standard 55: Thermal Environmental Conditions for Human Occupancy
- ASHRAE: Standard 62n: Ventilation for Acceptable Indoor Air Quality
- ASHRAE: Standard 90.1: Energy Standard for Buildings Except Low-Rise Residential Buildings
- ASHRAE: Standard 100: Energy Conservation in Existing Buildings
- ASHRAE: Standard 105: Standard Method of Measuring and Expressing Building Energy Performance
- ASHRAE: Standard 111: Practices for Measurement, Testing, Adjusting and Balancing of Building HVAC Systems
- ASHRAE: Standard 114: Energy Management Control Systems Instrumentation
- ASHRAE: Standard 135n: BACnet: A Data Communication Protocol for Building Automation and Control Networks
- ASHRAE HVAC System Duct Design
- California Energy Code: Non Residential Alternative Calculation Manual Standards
- CISPI Standards: Cast Iron Soil Pipe Institute
- EIA/TIA Standard 862, Building Automation Systems Cabling Standards for Commercial Buildings
- Factory Mutual Standards
- National Fuel Gas Code Standard 54
- National Fire Protection Association: Standard 96
- National Fire Protection Association: Standard 13
- Sheet Metal and Air Conditioning Contractors' National Association, Inc. (SMACNA)
- SMACNA HVAC Duct Construction Standards: Metal and Flexible
- SMACNA HVAC Air Duct Leakage Test Manual
- SMACNA Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems
- Underwriters Laboratories Standards

Design Guides

- ASHRAE: Guideline #4: Preparation of Operating and Maintenance Documentation for Building Systems
- California Energy Code: Non Residential Alternative Calculation Manual Guidelines
- California Public Utilities Commission: Pacific Gas and Electric Company: Saving By Design Program
- California Public Utilities Commission: Pacific Gas and Electric Company and Portland Energy Conservation, Inc (PECI): Building Commissioning Design Guidelines
- California Public Utilities Commission: Pacific Gas and Electric Company: Title 24 Non-Residential Mechanical and Acceptance Test Requirements
- IRI: International Risk Insurance
- ISA: Instrument Society of America: Instrument Data Sheet Formats
- IRI: International Risk Insurance
- Lonmark Protocol Guidelines
- National Institute for Occupational Safety and Health: Guidance for Protecting Building Environments from Airborne Chemical, Biological, or Radiological Attacks20.3 Electrical Codes and Standards

Codes

- NFPA-70 National Electrical Code.

- ANSI Std. C-2 National Electrical Safety Code.
- NFPA-101 Life Safety Code.
- California Code of Regulations - Title 24 - All parts and California Building Code.

Standards

- ANSI Std. 241 Recommended Practice for Electric Power Systems in Commercial Building (IEEE Gold Book).
- ANSI Std. 493 Recommended Practice for Design of Reliable Industrial and Commercial Power Systems (IEEE Gold Book).
- ANSI Std. P-1110 Recommended Practice for Powering and Grounding Sensitive electronic equipment (IEEE Emerald Book).
- Underwriters Laboratories (UL).

Codes

- California Code of Regulations, Title 24
- California Building Code
- California Fire Code
- California Electric Code
- California Mechanical Code
- California Energy Code
- National Electric Code

Standards

- ANSI/EIA/CEA - 709.1- B-2000 Control Network Protocol Specification
- ASHRAE: Standard 62.1: Ventilation for Acceptable Indoor Air Occupancy
- ASHRAE: Standard 111: Practices for Measurement, Testing, Adjusting and Balancing of Building HVAC Systems
- ASHRAE: Standard 114: Energy Management Control Systems Instrumentation
- ASHRAE: Standard 135n: BACnet: A Data Communication Protocol for Building Automation and Control Networks
- ASHRAE: Guideline #4: Preparation of Operating and Maintenance Documentation for Building Systems
- EIA/TIA Standard 862, Building Automation Systems Cabling Standards for Commercial Buildings
- California Nonresidential Alternative Calculation Method (ACM) Approval Manual - California Energy Code
- ISA: Instrument Society of America: Instrument Data Sheets
- Lonmark Standards by Echelon

Guidelines

- AMCA: Air Movement and Control Association Inc.
- California Utilities Commission: California Pacific Gas and Electric Company and Portland Energy Conservation, Inc (PECI): Energy Design Resources
- California Utilities Commission: Pacific Gas and Electric Company and Portland Energy Conservation, Inc (PECI):Pacific Energy Center, Building Commissioning Design Guidelines
- California Utilities Commission: Pacific Gas and Electric Company: California Title 24 Energy Code, Pacific Energy Center, Non-Residential Mechanical and Acceptance Test Requirements
- California Utilities Commission: California Pacific Gas and Electric Company: Pacific Energy Center, DDC Control Sequences for Demand Reduction and Energy Savings
- Specifying Digital Controls: www.ddc-online.org
- Specifying Lonmark: www.echelon.com, Lonmark Interoperability Guidelines

20.3 HVACR AUTOMATIC CONTROLS

CODES AND STANDARDS

Codes

- California Code of Regulations, Title 24

- California Building Code
- California Fire Code
- California Electric Code
- California Mechanical Code
- California Energy Code
- National Electric Code

Standards

- ANSI/EIA/CEA - 709.1- B-2000 Control Network Protocol Specification
- ASHRAE: Standard 62.1: Ventilation for Acceptable Indoor Air Occupancy
- ASHRAE: Standard 111: Practices for Measurement, Testing, Adjusting and Balancing of Building HVAC Systems
- ASHRAE: Standard 114: Energy Management Control Systems Instrumentation
- ASHRAE: Standard 135n: BACnet: A Data Communication Protocol for Building Automation and Control Networks
- ASHRAE: Guideline #4: Preparation of Operating and Maintenance Documentation for Building Systems
- EIA/TIA Standard 862, Building Automation Systems Cabling Standards for Commercial Buildings
- California Nonresidential Alternative Calculation Method (ACM) Approval Manual - California Energy Code
- ISA: Instrument Society of America: Instrument Data Sheets
- Lonmark Standards by Echelon

Guidelines

- AMCA: Air Movement and Control Association Inc.
- California Utilities Commission: California Pacific Gas and Electric Company and Portland Energy Conservation, Inc (PECI): Energy Design Resources
- California Utilities Commission: Pacific Gas and Electric Company and Portland Energy Conservation, Inc (PECI):Pacific Energy Center, Building Commissioning Design Guidelines
- California Utilities Commission: Pacific Gas and Electric Company: California Title 24 Energy Code, Pacific Energy Center, Non-Residential Mechanical and Acceptance Test Requirements
- California Utilities Commission: California Pacific Gas and Electric Company: Pacific Energy Center, DDC Control Sequences for Demand Reduction and Energy Savings
- Specifying Digital Controls: www.ddc-online.org
- Specifying Lonmark: www.echelon.com, Lonmark Interoperability Guidelines

20.4 LIGHTING CODES AND STANDARDS

Lighting design shall comply with California Building Code of Regulations: Title 24, Building Codes for energy efficiency standards, and shall strive to achieve a 15 percent efficiency increase above Title 24 requirements. This could be accomplished by reducing the connected lighting load, using controls exceeding minimum code requirements, or a combination of both.

The Illuminating Engineering Society of North America (IESNA) provides lighting design criteria. Applicable design criteria for spaces typically found in AOC facilities are listed below. While these are guidelines, there may be extenuating circumstances where the criteria are inadequate. In those cases, the design team shall provide an analysis explaining why the IESNA recommendations are inadequate, and an analysis of the proposed system that shall meet user requirements.

20.5 TELECOMMUNICATIONS STANDARDS

Apply the following standards when designing telecommunications systems:

- Judicial Branch of California, Administrative Offices of the Court's - LAN/WAN Network Architecture and Standards (September 16, 2002, Version 2.0)

- ANSI/TIA/EIA-568-B-1 - Commercial Building Telecommunications Cabling Standard Part 1: General Requirements
- ANSI/TIA/EIA-568-B-2 - Commercial Building Telecommunications Cabling Standard Part 2: Part 2: Balanced Twisted-Pair Cabling Components
- ANSI/TIA/EIA-568-B-2 - Optical Fiber Cabling Components Standard
- ANSI/TIA/EIA-569-A - Commercial Building Standard for Telecommunications Pathways and Spaces
- ANSI/TIA/EIA-598-B – Fiber Optic Cable Color Coding.
- ANSI/TIA/EIA-606-A - Administration for Telecommunications Infrastructure for Commercial Buildings
- ANSI/J-STD-607-A - Commercial Building Grounding and Bonding Requirements for Telecommunications
- ANSI/TIA/EIA-758 - Customer-Owned Outside Plant Telecommunications Cabling Standard
- TIA-942 – Telecommunications Infrastructures for Data Centers (Proposed)

Bulletins issued by ANSI/TIA/EIA in conjunction with the above referenced standards

20.6 AUDIO-VISUAL STANDARDS

The following standards shall apply:

- ANSI Y32.9: Graphic Symbols for Electrical Wiring and Layout Diagrams Used in Architecture and Building Construction.
- EIA RS-310-C: (ANSI C83.9) Racks, Panels, and Associated Equipment
- EIA RS-453: Dimensional, Mechanical, and Electrical Characteristics Defining Phone Plugs and Jacks
- National Electric Code (NEC)
- Society of Motion Picture and Television Engineers
- Underwriters Laboratories (UL)

20.7 CODES AND STANDARDS FOR NOISE ATTENUATION

The following codes and standards shall apply:

ASHARAE HVAC, Sound and Vibration Control Guidelines, American Society of Heating, Refrigerating and Air-Conditioning Engineers

ARI 443, Air-Conditioning and Refrigeration Institute: Standard for Sound Rating of Fan Coil Air Conditioner

ASTM E 477, American Society for Testing and Materials: Test for Duct Lining & Silencer Performance

ASTM C 423, American Society for Testing and Materials: Method for Measuring Sound Absorption

ASTM E 90, American Society for Testing and Materials: Method for Measuring Sound Transmission Loss

ASTM E 413, American Society for Testing and Materials: Determination of Sound Transmission Class

SMACNA, Sheet Metal and Air Conditioning Contractors National Association

20.8 CODES AND STANDARDS FOR FIRE PROTECTION

Fire protection design shall comply with the requirements of the prevailing State of California Building Code, California Fire Code, applicable NFPA Standards, and the local jurisdiction requirements.

Prevailing Codes

California Building Code.

California Fire Code.

Plumbing Code.

California Electrical Code.

Standards

NFPA-10 - Portable fire extinguishers.

NFPA-13 - Installation of sprinkler systems.

NFPA-14 - Installation of standpipe and hose systems.

NFPA-20 - Installation of centrifugal fire pumps.

NFPA-24 - Installation of private fire service mains and their appurtenances.

NFPA-25 - Water-based fire protection systems.

NFPA-70 - National Electric Code.

NFPA-72 - National Fire Alarm Code.

NFPA-2001 - Clean Agent Fire suppression System.

Underwriters Laboratories (UL).

Factory Mutual (FM).

Owner's Underwriter requirements.

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GLOSSARY

AC	Alternating Current
ADA	America with Disabilities Act
ADR	Alternate Dispute Resolution
AHU	Air Handling Unit
AISC	American Institute of Steel Construction Inc.
ANSI	American National Standards Institite
AOC	Administrative Office of the Courts
ARMM	Automated Retroactive Minimal Moderation
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASSE	American Society of Safety Engineers
ASTM	American Society for Testing and Materials
AV	Audio Visual
AWWA	American Water Works Association
AWG	American Wire Gauge
AWI	Architectural Woodwork Institute
BGSF	Building Gross Square Feet
BMS	Building Management System
CBC	California Building Code
CATV	Community Access Television

CCTV	Closed Circuit Television
CEA	Consumer Electronics Association
CEA	Canadian Electrical Association
CEO	Court Executive Officer
CFM	Cubic Feet per Munite
CGSF	Component Gross Square Feet
CMP	Cable Management Panel
CMU	Concrete Masonry Unit
CPTED	Crime Prevention Through Environmental Design
CRI	Color Rendering Index
DC	Direct Current
DCDV	Double Check Detector Valve
DCV	Demand Controlled Ventilation
DDC	Direct Digital Controls
DEPS	Digital Evidence Presentation System
DNL	Day-Night Average Level
DP	Differential Pressure
DPDT	Double-Pole, Double-Throw
DVD	Digital Versatile Disc
EIA	Electronic Industries Alliance
ELFEXT	Equal-Level Far-End Crosstalk
EMS	Energy Management System
EMT	Electrical Metallic Tubing
ENG	Electronic News Gathering
ENT	Electrical Nonmetallic Tubing
EPDM	Ethylene Propylene Dimonomer

FCC	Federal Communications Commission
FCCC	Federal City Communications Corporation
FCS	Family Court Services
FDC	Fire Department Connections
FEMA	Federal Emergency Management Agency
FM	Fault Management
FPM	Foot per Minute
GPM	Gallon per Minute
GUI	Graphical User Interface
HP	Horse Power
HVAC	Heating Ventilation, Air Conditioning
HVACR	Heating, Ventilation, Air Conditioning and Refrigeration
IMC	Intermediate Metallic Conduit
ISO	International Organization for Standardization
IVR	Interactive Voice Response
LAN	Local Area Network
LCCA	Life Cycle Cost Analysis
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LEED	Leadership in Energy and Environmental Design
MERV	Minimum Efficiency Reporting Value
MCC	Motor Control Center
NC	Noise Criterion
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NEXT	Neat-End Cross Talk

NFPA	National Fire Protection Association
NIC	Noise Isolation Class
NRC	Noise Reduction Coefficient
NSC	Nonstructural Seismic Coordinator
NSF	Net Square Feet
NST	National Standard Thread
OCCM	Office for Court Construction and Management
OSHA	Occupational Safety & Health Administration
OTDR	Optical Time Domain Reflectometer
PH	Phase
PIV	Post Indicator Valve
PoE	Power over Ethernet
PS-ELFEXT	Power-Sum Equal Level Far-End Crosstalk
Psi	Pounds per Square Inch
PSNEXT	Power-Sum Near-End Crosstalk
PVC	Polyvinyl Chloride
RMS	Root-Mean-Square
SF	Square Feet
STC	Sound Transmission Class
TEFC	Totally Enclosed Fan-Cooled
TIA	Telecommunications Industry Association
TVSS	Transient Voltage Surge Suppressor
UL	Underwriters Laboratories
UPS	Uninterruptible Power System
USC	United States Code
USGBC	United States Green Building Council

UTP	Unshielded Twisted Pair Cabling
VAC	Volts Alternating Current
VAV	Variable Air Valve
VAV	Variable Air Volume
VCR	Video Cassette Recorder
VCT	Vinyl Composition Tile
VDT	Video Display Tube
VFD	Variable Frequency Drives
WLAN	Wireless Local Area Network